

Appraisal Of The Role Of Self-Efficacy On Students' Academic Achievement In Secondary School Chemistry

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Abstract – Self-efficacy as an independent variable has been identified as one of the most important factors that predict students' continuous academic achievement. The role of self-efficacy on students' academic achievement in chemistry has been examined among 150 students in two Oyo State schools of science. A questionnaire that contains 20 items on students' academic self-efficacy was employed, while the academic achievement of the students was measured through an achievement test containing 20 chemistry questions. A descriptive survey research design was employed for the study. A Pearson correlation was utilized to determine the strength, as well as the positive or negative direction, of relationships between the variables. Linear regression was employed to determine the extent to which academic achievement is related to self-efficacy at the $P < 0.05$ statistical significance level. The analysis was carried out using R software version 3.6.2. The results of the analysis revealed a weak positive correlation between academic achievement and students' self-efficacy. It was concluded that self-efficacy has a significant role in promoting academic achievement in chemistry. Therefore, students should develop themselves by cultivating the attitude of practicing everything they are being taught in chemistry every day. It is recommended that classroom activities be made very interesting and challenging for students' efforts. Support and encouragement should be given to each student as he or she does his or her best to complete the assigned task.

Keywords – Academic Achievement, Chemistry, Education, Self-efficacy

I. INTRODUCTION

Education in every human community is an indispensable instrument for human progress and national development. Any nation that lacks a complete educational culture and philosophy stands to suffer deterioration because education (primary, secondary, and higher) is a major factor in the overall development of all countries. Secondary education is recognized as a significant level of training students for peaceful living within society and for higher education. Tutors at the secondary level of education have a pronounced impact on developing the students' skills and knowledge, which are needed for an effective contribution to every society. Students' academic performance in secondary school is considered an important variable by both teachers and educational psychologists because it establishes students' success in their studies (Moyosola et al., 2013; Ajay, 2016). Performance has been considered an instrument in determining many factors that are responsible for causing variance in academic achievement (Mimar, 2012).

Chemistry is one branch of natural science. Chemistry deals with every aspect of daily life, such as food, drink, clothing, medicine, housing, vehicles, and many others. Chemistry explains a lot about the phenomena that occur in everyday life; therefore, chemistry cannot be separated from nature. Chemistry helps people solve many difficult life problems (Tarhan & Sesen, 2013; Alkan, 2016; Rusmansyah et al., 2019). The decline in academic performance of students in science subjects in secondary school in Nigeria has been reported over the years, and this has been a major concern for the government, teachers, and parents. The poor performance has been attributed to some factors such as poor study habits, laziness, ineffective classroom instruction, inadequate provision of instructional material, and a lack of academic motivation and self-efficacy (Akpan, 2000). Many

researchers have investigated the effects of the above-mentioned factors on academic performance among secondary school students.

Academic self-efficacy is one of the students' psychological variables that deal with students' self-belief, motivational orientation, and judgments about their ability to successfully attain educational goals (Baanu *et al.*, 2016). Students' belief in their innate abilities involves valuing their cognitive strengths, determination, and perseverance to overcome obstacles that would interfere with utilizing their innate abilities to achieve academic goals. The strength of students' efficacy belief affects their choice for plans and actions (Hoy *et al.*, 2006). Efficacious students do not only set goals and try hard to achieve the target goals (Meral *et al.*, 2012) but they also exhibit coping behaviour, and perseverance when they encounter difficulties, more organized and even perform better than students who doubt their learning capabilities (Suleiman *et al.*, 2019). Self-efficacy is considered as an important variable required to be measured because positive self-efficacy correlate with motivation, learning behavior, future general expectations and learners' performance. Self-efficacy has a direct positive impact on students' scientific attitudes toward chemistry (Kurbanoglu & Akim, 2010).

According to Rahil *et al.*, (2006), self-system provides an individual the ability to modify his environment and influences his subsequent performance. Therefore, the confidence a student has in him/her is a chief factor in practicing control and personal efficacy. The student behaviour is affected in two ways i.e. either engagement of the student in any task he/she feels competent and confident or avoidance of those that he feels contrary. Self efficacy helps to determine how much effort, perseverance and resilience being put on a task. It is believed that self-efficacy triggers emotional reactions. For example, individuals with low self efficacy believe that a task is tough and hence build stress, depression and a narrow vision on how to solve problems. On the other hand, those with high efficacy would be more relax in solving difficult tasks. Therefore, these influences are strong determinants of the individual's level of achievement. Many researchers have investigated a relationship between self efficacy in the academic settings.

II. LITERATURE REVIEW

The association between students' achievements in chemistry and self-efficacy beliefs, gender, and locality among Woreillu high school grade 10 students was investigated by Asfaw (2022). The correlation was determined by the Pearson correlation test. The correlation between the students' achievements was found to be positive. Bedel (2016) determined the impact of academic self-efficacy and attitudes regarding teaching in pre-service early childhood education teachers and the relationships among the dependent and independent variables. Academic self-efficacy was observed in the study to be the only meaningful predictor of academic motivation and performance. The relationship between self-efficacy and academic achievement was investigated by Yaman (2015) in higher education institutions. It was found that the relationship between self-efficacy and GPA was partially mediated by effort regulation. On account of the fact that students with high self-efficacy were found to excel academically.

Meera & Jumana (2015) examined the relationship between self-efficacy and academic performance of secondary school students in English. The students with high self-efficacy were found to show better performance in learning and thinking, hence better performance. Research exploring a relationship between self efficacy and students' academic performance on the basis of gender was carried out by Bushra & Lubna (2015). A positive relationship between self-efficacy and academic performance was observed with male students, who showed a higher level of self-efficacy as compared to female students. The impact of academic self-efficacy on academic performance was assessed on university science students in Katsina State, Nigeria. The academic self-efficacy scale and students CGPA records were applied in obtaining data for the study. A weak but significant positive correlation was observed to exist between students' academic self-efficacy and their performances (Suleiman *et al.*, 2021). An investigation of the effect of self-efficacy on students' achievement was evaluated in science secondary school (Aslam & Ali, 2021). The students' information on self-efficacy was obtained through questionnaire. Female students were observed in to have lower self-efficacy than male students. Also, students from urban localities possessed higher self-efficacy than students from rural localities, while no significant differences in self-efficacy were found based on their mother tongue.

Academic achievement of Nigerian secondary school students in chemistry has not been satisfactory to many for nearly a decade now, and this is becoming one of the most exigent puzzles facing students as well as teachers that require an urgent solution. Many elements have been identified as the potential causes of low academic achievement in chemistry, and researchers are conducting research in order to find solutions to the problem of low academic achievement. However, there is a paucity of

reports on the effect of self-efficacy on students' academic achievement in chemistry, particularly in the southwest part of Nigeria. Therefore, this research is conducted to establish the role of self-efficacy on the academic achievement of secondary school students in chemistry. The following questions shall be addressed within the study:

1. What is the correlation between self-efficacy and academic achievement in chemistry among secondary school students?
2. What is the contribution of self-efficacy to the students' academic achievement?

III. METHODS/METHODOLOGY

Research Design and Population of Study

A descriptive survey research design was employed with the use of a questionnaire to obtain data from the respondents. The total number of 150 students from Senior Secondary School Two and Three (SSS 2& 3), which comprised 66 male and 84 female students, were randomly selected from Ipade and Oladipo schools of science. Seventy-five students were selected from each school.

Self-efficacy

Self-efficacy as an independent variable has been identified as one of the most important factors that predict students' continuous academic achievement. Data on the students' self-efficacy was obtained through a self-designed questionnaire (Esen and Yesim, 2003). The questionnaire consists of 20 items that are statements about various aspects of self-efficacy with responses anchored based on the four Likert points: strongly agree, agree, strongly disagree, and disagree.

Academic Achievement

The academic achievement of students in chemistry was measured through a test based on the chemistry syllabus for senior secondary school students in chemistry. The academic achievement test contains twenty chemistry questions.

Procedure

The survey forms, which contained demographic questions, a motivation scale, and an achievement test, were administered to the randomly selected respondents. Enough time was given to the respondents to complete the questionnaire and answer the achievement test. The respondents were allowed and encouraged to express their honest feelings without any bias. The questionnaires were retrieved from the respondents immediately after their completion.

IV. RESULTS

Pearson moment correlation and linear regression analyses were applied to find the effect of self-efficacy on the students' academic achievement. Self-efficacy is considered an independent variable, while the students' academic achievement is considered the dependent variable.

Table 1. Students' Demographic

Gender	Number	Percentage
Male	66	44
Female	84	56
Total	150	100

Table 1 above shows that 150 students were selected for the study, and out of the 150 students, 66 (44%) were male students and 84 (56%) were female students.

Table 2. Levels of independent and dependent Variables

Variable	Frequency	Percentage
Self-efficacy		
Low	5	3
Medium	78	52
High	67	45
	150	100
Achievement Scores		
Low	50	33.33
Medium	53	35.33
High	47	31.33
Total	150	99.99

Low (mean range = 1.0 – 1.99), Medium=(mean range 2.0-2.99) and High (mean range = 3 – 4.0).

The level of self-efficacy was tested using the 4-point Likert scale, which ranged from "strongly disagree" to "strongly agree". The mean range of each independent variable was organized by the percentage of participants whose responses were rated as low (means = 1.0–1.99), medium (means = 2.0–2.99), and high (means = 3.0–4.0) for each independent variable as shown in Table 2. About 45% and 52% of participants possessed high and medium self-efficacy values, while 3% possessed low self-efficacy, as depicted in the table.

Table 3. Descriptive Statistics of Independent and Dependent Variables

Variable	Mean	SD	Min	Max	Skewness
Self-efficacy	57.03	9.66	36	77	0.08
Academic achievement	39.17	10.41	12	60	-0.33

The mean of self-efficacy of the students as shown in Table 3 is 57.03, and the standard deviation (SD) is 9.66 with a skewness of + 0.08, while the mean of academic achievement of the students is 39.17, and the SD is 10.41 with a skewness of - 0.33.

Table 4. Descriptive Statistics of Academic Self-Efficacy

S/N	Items	Mean	SD	Min	Max
1.	I can learn what is being taught in chemistry class.	3.32	0.71	1.00	4.00
2.	I find it easy to comprehend all aspects of chemistry.	2.20	1.16	1.00	4.00
3.	I can explain fundamental concepts in chemistry	2.62	1.07	1.00	4.00
4.	If I practice every day, I could become the best chemistry student in my school.	3.58	0.66	1.00	4.00
5.	I am sure that I will achieve the mark that I set for myself in chemistry.	3.34	0.84	1.00	4.00
6.	I will perform well in chemistry no matter what.	3.37	0.70	1.00	4.00
7.	I find chemistry demanding and can cope with it.	3.24	1.20	1.00	4.00
8.	When I am labouring to solve chemistry problems, I remain focus to achieve my desired goal.	3.24	0.85	1.00	4.00
9.	I can connect chemistry with other sciences.	3.00	0.97	1.00	4.00

10.	I can remain calm when finding it difficult to solve chemistry problems because I can rely on my coping abilities.	2.66	1.02	1.00	4.00
11.	I can read and understand chemistry without attending class.	2.04	0.99	1.00	4.00
12.	I can get another student to explain the note to me whenever I missed chemistry class.	2.59	1.08	1.00	4.00
13.	Even as hard as chemistry is, I can cope with it and become the best student.	3.16	0.89	1.00	4.00
14.	Chemical equations in chemistry are not difficult for me to balance.	2.70	1.04	1.00	4.00
15.	I can solve everyday problems by applying chemistry knowledge.	2.45	1.14	1.00	4.00
16.	I can read the formulas of elements and compound properly.	2.76	1.07	1.00	4.00
17.	I can select an appropriate formula to solve a chemistry problem.	2.62	0.97		
18.	I can describe properties of all the matters in nature using chemistry concept.	2.65	1.10	1.00	4.00
19.	I can work with chemicals.	2.63	1.02	1.00	4.00
0.	I am knowledgeable in identifying career related to chemistry.	3.0	0.93	1.00	4.00

A descriptive analysis of the specific items for self-efficacy was constructed with several remarkable results from the scale where the students were asked in the self-efficacy section to rate their belief in their ability to succeed academically in chemistry.

Students responded to the items as shown in Table 4 with fairly high responses, ranging from the highest with a mean score of 3.58 to the lowest with a mean of 2.04 on a scale of 1-4. Item #4, which stated, "If I practice every day, I could become the best chemistry student in my school" (mean = 3.58; $SD = .66$), was the highest rated item of all items measuring independent variables presented for the entire scale. Also highly scored were items #5: "I am sure that I will achieve the mark that I set for myself in chemistry" (mean = 3.34, $SD = 0.84$), and #6: "I will perform well in chemistry no matter what" (mean = 3.62, $SD = 0.64$). Item #11, "I can read and understand chemistry without attending class" (mean = 2.04; $SD = 0.99$), had the lowest scored response. Another response with the lowest mean was item #2: "I find it easy to comprehend all aspects of chemistry" (mean = 2.20, $SD = 1.16$), and item #15: "I can solve everyday problems by applying chemistry knowledge" (mean = 2.45, $SD = 1.14$).

Table 5. Descriptive statistics of correlation of Academic achievement and Academic self-efficacy

Pearson correlation	DF	Mean	SD	Academic achievement	T	P
Self-efficacy	148	57.03	9.66	0.241	3.084	0.002

Correlation is significant at the 0.05 level

Academic achievement is found in Table 5 to have a positive correlation with self-efficacy [$r_s = 0.241$, $p < 0.05$]. Figure 1 below depicts the relationship between self-efficacy and students' academic achievement in chemistry. This shows that high self-efficacy leads to better academic achievement.

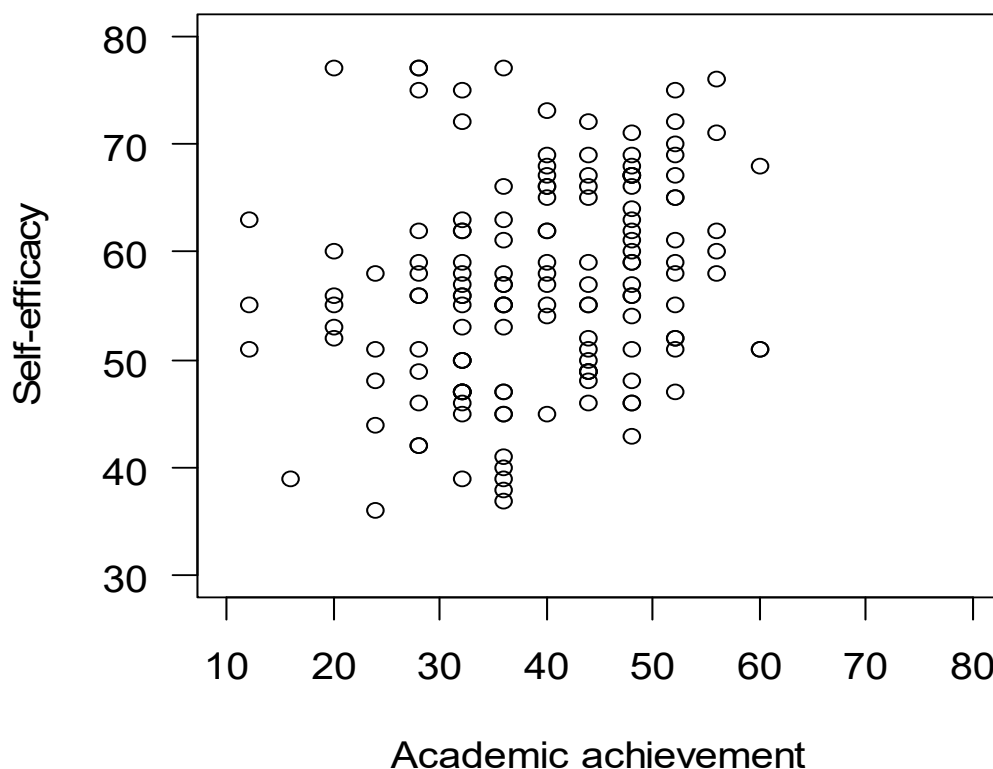


Figure 1. Plot of academic self-efficacy against student's academic achievement in chemistry

Table 6. Regression Analysis of students' self-efficacy as a predictor of Academic Achievement

Coefficients	Estimate	Std. Error	t value	Pr(> t)
Intercept	23.71780	5.02940	4.716	5.51e-06 ***
Self-efficacy	0.26822	0.08696	3.084	0.00244 **

Residual standard error=10.26, Multiple $R^2 = 0.06039$, Adjusted $R^2 = 0.05405$

The residual standard error of 10.26 established the model as a good model. This model also shows that with increase in self-efficacy there would be increase in students' academic achievement. The R-square value of 0.06039 represents the total variability of the dependent variable as explained by the independent variables. The value revealed that self-efficacy in learning explains 6.03% of the total variability in academic achievement of students in chemistry.

V. DISCUSSION

Self-efficacy has a mean of 57.03 ($SD = 9.66$), with 45% within the range of high level, 52% within the medium range, and 3% within the range of low level. It was revealed from the ranges that many students are sure of themselves and will succeed academically in chemistry if they practice every day. The achievement scores have a mean of 39.17 and a standard deviation (SD) of 10.14 with a skewness of -0.33. However, the higher mean value of the independent (self-efficacy) variable than the dependent variable indicates the contribution of the independent variables to the academic achievement of the students in chemistry.

The first question was answered by considering the value of the Pearson moment correlation. From the r -value of 0.241 ($p = 0.022$), self-efficacy was observed to have a positive association with the students' academic achievement. This is in line with the investigations carried out by Suleiman *et al.* (2021) and Meera and Jumaa (2015), which revealed a positive correlation between self-efficacy and the students' academic performance.

The second research objective was answered through regression analysis, where an R-squared value of 0.0603 with a p value of 0.002 was obtained. The R-squared value revealed that self-efficacy contributes 6.1% to the students' achievement in chemistry. That is 6.1% of the total variability in students' academic achievement that could be explained by self-efficacy. When the independent variable is constant, students' academic achievement is predicted to decrease by 23.72%. Self-efficacy is predicted to increase the academic achievement of the students by 0.268. Therefore, for any increase in academic self-efficacy in the students' learning, academic achievement is envisaged to increase by 2.89%. The students' academic achievement was found in this study to depend on the level of self-efficacy. This corroborates Atoum & Al-Momani (2018) and Asfaw (2022), which stated that the higher the self-efficacy, the higher the academic performance. Consequently, it can be presumed that self-efficacy is one of the predictors of students' academic achievement in chemistry.

VI. CONCLUSION AND RECOMMENDATIONS

Self-efficacy is about having confidence in one's own ability to do certain tasks or solve problems that one may come across in one's own life. It is in this sense that self-efficacy plays an important role in promoting academic achievement in chemistry. Academic success can only be achieved in chemistry when a student practices every day.

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

1. Classroom activities should be made very interesting and challenging for students' efforts.
2. The difficulty level of the task given to each child should be commensurate with his or her capability.
3. Each student who does his or her best to complete the assigned task should be supported.
4. Teachers and counseling psychologists should be free with praise and constructive in criticism.

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