International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 6 Issue 4, May-June 2022 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Academic Self-Efficacy as a Predictor of Chemistry Achievement among Senior Secondary School Students in Anambra State

Enekwechi, Emelda Ego

Department of Natural Science, School of General Studies, Federal Polytechnic, Oko, Anambra State, Nigeria

ABSTRACT

The study focused on academic self-efficacy as a predictor of chemistry achievement among senior secondary school students. The design adopted for the study was correlational survey. The population of the study was 8, 901 senior secondary school year two (SS2) students offering chemistry in Anambra state. The sample for the study was 400 students obtained using random sampling. The instruments for data collection were Chemistry Self-efficacy Scale (CSES) adopted from Nwanze (2021). The instruments were administered via google forum with the aid of four research assistants. Data obtained from the study was analyzed using simple and multiple linear regressions. The findings of the study showed that academic self-efficacy is significant predictor of achievement in chemistry, accounting for 12% and 12% of variance in achievement respectively. Self-efficacy dimensions also significantly co-predicted achievement in chemistry. It was therefore recommended that chemistry teachers along with the school counselors should embed in their instructional process, examples and encouraging stories of men and women who thrive in the area of chemistry.

KEYWORDS: *self-efficacy, chemistry, secondary, regressions*

How to cite this paper: Enekwechi, Emelda Ego "Academic Self-Efficacy as a Predictor of Chemistry Achievement among Senior Secondary School Students in Anambra State" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-6 | Issue-4, June 2022, pp.1385-1390, URL: www.ijtsrd.com/papers/ijtsrd50325.pdf

IJTSRD50325

INTRODUCTION

Chemistry is one of the science subjects offered at secondary school level in Nigeria. Education in chemistry is crucial to improving the standard of learning, research, and development, as well as ensuring that students have the information necessary to generate goods and services that meet human requirements for food, medical care, and other items that enhance quality of life. Despite the importance of chemistry, senior secondary school students in Nigeria including especially Anambra state, have not significantly improved in their performance in chemistry in external examinations like West African Secondary School Certificate Examination (WASSCE). The Chief Examiner's Reports over the years have revealed that students consistently display a variety of shortcomings in the exams, including a lack of conceptual understanding of chemistry. The percentage of students who earned a credit pass in chemistry ranged from 44.16 percent to 46.16 percent, according to a study of student performance from 2007 to 2009. Except for 2010, this saw a 50.7 percent pass rate, the percentage of students who earned a credit pass ranged from 2010 to 2012. The percentage of students who passed at credit consistently decreased from 2013 to 2016: from 72.34 percent in 2013, to 62.49 percent in 2014, to 60.6 percent in 2015, and to 57.74 percent in 2016. Reports on students' lowest chemistry performance from 2017 to 2019 were gathered. This is due to the highest point in student drop in 2018. The abysmal achievement of students in chemistry has been attributed to a number of factors among which the teacher methods adopted by chemistry teachers is most prominent.

Researchers have focused on developing innovative instructional strategies that can help students overcome the challenges of learning chemistry. Thus, Research recommendations in the area of instructional or pedagogical approaches have continued to clamour for adoption of innovative strategies of instruction. These innovations in instruction come either as a shift from the traditional mode of instruction, integration of Information and Communication Technologies (ICTs) adaptable in the classroom and use of students-centred strategies

known to bear beneficial boost for students' achievement and other academic achievement determinant. The fundamental questions become: What are some of these innovative instructional strategies? Can the innovative instructional strategies be implemented in the Nigerian secondary school classroom setting especially in Anambra state?, and What are the challenges to be overcomed in order to ensure effective implementation of these innovative instructional strategies?. These questions have been adequately addressed given the depth of research on innovative instructional strategies to improve chemistry achievement. There is a need therefore, to shift the focus of research on instructional strategies to the factors relating to the students to themselves such as their academic self-efficacy.

Academic self-efficacy refers to the students' beliefs and attitudes toward their capabilities to achieve academic success, as well as belief in their ability to fulfill academic tasks and the successful learning of the materials (Senol, Isiksal & Yusuf, 2018). Acccording to Sadia and Uyar (2013), it refers to a person's conviction that they can successfully achieve at a designated level in a specific academic subject area. Self-efficacy is the degree of assurance people have in their capacity to carry out plans of action or achieve particular performance goals. Self-efficacy is an importance factor learning especially for science subjects like chemistry (Nwanze and Okoli, 2021). This is because, the learners with high levels of self-efficacy attribute their failures to lower attempts rather than lower ability, while those with low self-efficacy attribute their failure to their low abilities (Brown and green, 2015). Therefore, self-efficacy can influence the choice of tasks and perseverance while doing them.

Students' self-efficacy beliefs have a big impact on whether they will put in the effort necessary to complete a task and keep up with academic challenges. When academic tasks and chemistry learning are challenging, people with a high level of self-efficacy attempt them and remain trying, whereas people with a low level of self-efficacy frequently give up easily (Witt0Rose, 2003; Cascio, Botta and Anzaldi, 2013). According to Romppel, Herrmann-Lingen, Wachter, Edelmann, Dungen, Pieske & grande, 2013), self-efficacy affects how a task is chosen and committed to, how much energy is expended on it, and how well it is performed. Students' belief in their apparent potential to succeed in any academic task is, thus, a measure of their self-efficacy.

Studies on academic self-efficacy and academic achievement have shown that there exist significant relationships between the two variables (Lane & Lane, 2001; Yazachew, 2013; Rudina, 2013; Maria, 2014). These studies established that students' academic self-efficacy significantly influence their academic achievement. However, no of such studies have examined how academic self-efficacy may predict senior secondary school chemistry achievement in Anambra state and how the individual dimensions of academic self-efficacy co-predict achievement. This study was therefore necessitated by these research gaps.

Purpose of the Study

The purpose of the study was to investigate academic self-efficacy and attitude towards chemistry as predictors of chemistry achievement among senior secondary school students. Specifically, the study sought to determine the:

- Predictive power of academic self-efficacy on senior secondary school students' achievement in chemistry.
- Predictive power of the individual dimensions of academic self-efficacy on senior secondary school students' achievement in chemistry.

Research Questions

The following research questions guided the study.

- What is the predictive power of academic self-efficacy on senior secondary school students' achievement in chemistry?
- What is the predictive power of the individual dimensions of academic self-efficacy on senior secondary school students' achievement in chemistry?

Hypotheses

The following hypotheses were tested at 0.05 level of significance.

- Students' emotional intelligence scores do not significantly predict their academic achievement in mathematics.
- Students emotional intelligence dimensions (perceiving emotions, facilitating thoughts, understanding emotions and managing emotions) do not significantly predict their academic achievement in mathematics.

Methods

The study adopted the correlational survey design. The study was conducted in Anambra State, Nigeria. The study population comprised all 8,901 senior secondary school year two students offering chemistry in Anambra state. Four hundred students were involved in the study. The sample was obtained through random sampling. Four education zone out of the six education zones in Anambra state was first selected. In each of the selected education zones, 10 secondary schools were selected at random. In each

school, 10 chemistry students were selected at random for the study.

The instruments for data collection are Chemistry Self-efficacy Scale (CSES) adopted from Nwanze (2021). CSES was a 32 item scale designed to measure students' self-efficacy for general Chemistry (Items 1-5), domain-specific self-efficacy for Chemistry (Items 6-13), task-specific self-efficacy for Chemistry enquiry (Items 14-21) and self-efficacy for Chemistry self-regulated learning (Items 22-32).. The instrument required the students to rate their belief or perception that they are capable of performing specific Chemistry task on a scale of one (not at all) through five (very well). The validity of the instrument was as established by Nwanze (2021) and the reliability of the CSES was determined using Cronbach's Alpha to be 0.81.

The instrument was administered to the students through the help of the four research assistants via google survey. The research assistants obtained permission form the school authority and copied the hyperlink into two palm-tops. The palm tops were given to the regular chemistry teacher in the school who selected 10 students at random for the study. The students were invited to the chemistry laboratory and the instrument was opened for two students to respond to at a time while the teacher compiled the chemistry achievement for two terms. The research assistants determined the average of the chemistry scores. The whole data was collated by the researcher for data analysis. Data generated from the study were analyzed using simple linear and multiple regressions. The interpretation of the correlation coefficient was according Nworgu (2015) who provided a three-way guide for interpreting correlation coefficient values when a large number of pairs of scores have been correlated. They are as follows: $r = \pm.30$ *and below*, low relationship; $r = \pm.30$ *to below* ± 0.80, moderate relationship and $r = \mp.80$ and above, high relationship. The null hypotheses were tested at 0.05 level of significance and the following decision rule: reject the null hypothesis whenever Pvalue is less than or equal 0.05 (P<0.05), do not reject null hypothesis whenever Pvalue is greater than 0.05 (P>0.05).

Results

Research Questions 1: What is the predictive power of academic self-efficacy on senior secondary school students' achievement in chemistry?

Table 1 PREDICTIVE POWER OF ACADEMIC SELF-EFFICACY ON STUDENTS' ACHIEVEMENT IN CHEMISTRY

Model	R	R^2	Adjusted R^2	Unstandardized coefficients (b)	Std. Error	Decision
Constant	.138[a]	.019	.016	52.854	10.045	Low positive relationship
Self-efficacy				.144		
Predictors: (Constant), Entrepreneurial Aspiration						

Table 1 shows that a low positive relationship (R = 0.138) exists between students' self-efficacy and their achievement in chemistry. The R-Square value of 0.011 indicates that 1.9% of the variance in chemistry scores is explained by students' academic self-efficacy.

Hypothesis 1: Achievement scores in chemistry are not significantly predicted by senior secondary school students' academic self-efficacy.

TABLE 2 TEST OF SIGNIFICANCE OF PREDICTION OF ACHIEVEMENT IN CHEMISTRY BY ACADEMIC SELF-EFFICACY

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	583.754	1	583.754	5.785	.017[b]
	Residual	30069.482	298	100.904		
	Total	30653.237	299			
a. Dependent Variable: Achievement						
b. Predictors: (Constant), Self-efficacy						

Table 2 shows academic self-efficacy is a significant predictor of achievement in chemistry, F (1, 298) = 5.785, P < 0.05. Therefore the null hypothesis was rejected. The conclusion was that achievement scores in chemistry are significantly predicted by senior secondary school students' academic self-efficacy.

Research Question 2: What is the predictive power of the individual dimensions of academic self-efficacy on senior secondary school students' achievement in chemistry?

Hypothesis 1: Students' emotional intelligence scores do not significantly predict their academic achievement in mathematics.

TABLE 3 RELATIVE CONTRIBUTION OF THE INDIVIDUAL DIMENSIONS OF ACADEMIC SELF-EFFICACY TO SENIOR SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN CHEMISTRY

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	15.280	2.186		6.990	.000
	Self-efficacy for general chemistry	.905	.155	.192	5.840	.000
	Domain-specific self-efficacy for chemistry	1.248	.160	.283	7.822	.000
	Self-efficacy for self-regulated learning	1.888	.112	.597	16.927	.000

a. Dependent Variable: Achievement in Chemistry

Table 3 shows the standardized beta coefficient which indicates correlation between variables. The unstandardized beta coefficient shows the predictive powers of each academic self-efficacy dimensions which indicates their relative contribution to achievement in chemistry. Table 3 shows that academic self-efficacy for general chemistry has a low positive relationship (R = 0.192) with students' achievement in chemistry, domain-specific self-efficacy has a low positive relationship (R = 0.283) with achievement in chemistry while self-efficacy for self-regulated learning has a moderate positive relationship (R = 0.597) with achievement in chemistry. Table 3 also reveals that with a unit increase in the self-efficacy for general chemistry, achievement in chemistry increases by 0.905; with a unit increase in domain-specific self-efficacy for chemistry, achievement in chemistry increases by 1.248; and with a unit increase in self-efficacy for self-regulated learning, achievement in chemistry increases by 1.888. The order of relative contribution to increment in chemistry achievement from the highest to lowest by students' self-efficacy therefore is; self-efficacy for self-regulated learning (1.888), followed by domain-specific self-efficacy for chemistry (1.248) and self-efficacy for general chemistry (0.905).

Hypothesis 2: Achievement scores in chemistry are not significantly co-predicted by the individual dimensions of senior secondary school students' academic self-efficacy.

TABLE 4: TEST OF SIGNIFICANCE OF PREDICTION OF ACHIEVEMENT IN CHEMISTRY BY ACADEMIC SELF-EFFICACY

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21849.403	3	7283.134	244.871	.000[b]
	Residual	8803.834	296	29.743		
	Total	30653.237	299			

a. Dependent Variable: Achievement
b. Predictors: (Constant), Self-efficacy for self-regulated learning, Self-efficacy for general chemistry, Domain-specific self-efficacy for chemistry

Table 4 shows that the individual dimensions of academic self-efficacy significantly co-predict achievement in chemistry, F (1, 296) = 244.871, P < 0.00. Therefore the null hypothesis was rejected. The conclusion was that achievement scores in chemistry are significantly co-predicted by the individual dimensions of self-efficacy of senior secondary school students.

Since the joint and individual association between the different domains of academic self-efficacy and achievement in chemistry is significant, the regression model ($Y= a + bX_1 + cX_2 + dX_3$) for the prediction of achievement score in chemistry as can be derived from Table 3, where Y = Achievement in chemistry, a (constant) = 15.280 and b value = 0.905, c value = 1.248, d value = 1.888 is:

AC = 15.280 + (0.905) SFGC + (0.905) DSSC + (1.248) SFSL

Where, AC = Achievement in Chemistry and SFGC = Self-efficacy for general chemistry, DSSC = Domain-specific self-efficacy for chemistry, SFSL = self-efficacy for self-regulated learning.

Discussion

The findings of the study showed that academic self-efficacy significantly predicting students' achievement in chemistry, predicting 1.9% of the variance in chemistry scores. The fact that academic self-efficacy can encourage high motivation to achieve goals during the learning process helps to explain the observed finding. High self-efficacy people will inspire motivation. An individual's skills,

efforts, and abilities are used as the drive for achievement, and before the individual can attain these goals, he or she must have faith in their potential. The influence that can be given can be in the form of direct or indirect effects, in this case, a person who has high self-confidence in his abilities himself (self-efficacy) will try to master and conquer any given exam questions, further supporting Bandura's claim that self-efficacy is a significant factor in determining learning achievement. Having a learning strategy and a pattern of learning arrangements are two efforts that are unquestionably based on or followed by this belief. However, if self-confidence is not accompanied by actual action, it will not have an impact on learning performance. Learning efforts build the confidence that is owned, which will subsequently boost learning achievement (Santrock, 2013).

The finding of the study is in line with the findings of Lane and Lane (2001) that 'self-efficacy to cope with the intellectual demands of the program' predicted 11.5% of performance variance. Given that there was a 13-week time gap between self-efficacy and performance and the complexity of the task was high, findings from the study further showed that self-efficacy has some utility in an academic setting and is correlated significantly with academic achievement. Again, the findings of the study lend credence to the findings of Yazachew (2013) who revealed that a significant relationship exists between students' self-efficacy and achievement.

The findings of the study showed that the self-efficacy dimension for self-regulated learning proved to be the highest significant contributor to students' achievement in chemistry. Researchers in the field of education have discovered a strong correlation between self-regulated learning and conscientiousness, learning motivation, and performance self-efficacy (Pintrich, 2004; Fernandez-Rio et al., 2017). Excellence can only be attained with practice. Planning, effort, and patience are required for this over time. This process is aided by self-regulated learning. It enables them to develop into independent learners who can follow their own interests. In a cycle of self-regulated learning, a student organizes a task, executes it, assesses how they did, and then comments on the results. The cycle then resumes as the student makes adjustments and is ready for the subsequent challenge using the reflection. Academic self-efficacious students have the capacity for self-regulatory learning. The study's findings are consistent with those of Rudina (2013), who found a substantial link between self-efficacy and academic achievement.

Conclusion

The conclusion drawn from the study is that academic self-efficacy of senior secondary school students is a significant factor in their achievement in chemistry. To attain a good achievement in chemistry, senior secondary school students must develop high self-efficacy for general chemistry, for academic self-regulated learning and a domain-specific self-efficacy for different chemistry contents.

Recommendation

In the light of the findings and conclusion, the following recommendations are made:

- Diagnostic analysis of students' performance in chemistry and investigations into senior secondary schools academic self-efficacy should be conducted regularly to ensure that they maintain high self-efficacy need for greater achievement in chemistry.
- Senior secondary school chemistry teachers should model for students appropriate ways to remain highly self-efficacious in academic matters.
- Chemistry teachers should embed in the lessons, examples, encouraging stories of chemistry icons and men and women of all ages who succeed in chemistry.

References

[1] O. Sadia and M. Uyar. 'The relationship between self-efficacy, self-regulated learning strategies and achievement: A path model' Journal of Baltic Science Education vol. 12, pp. 21-33. (2013).

[2] C. Nwanze and J.N. Okoli. 'Path analysis of factors affecting academic achievement of tertiary education students in chemistry in Delta state' African Journal of Science, Technology & Mathematics Education, vol. 6 no .1, pp. 75-88. (2021).

[3] A.H. Brown & T.D. Green. 'The essentials of instructional design: Connecting fundamental principles with process and practice' London: Routledge. (2015).

[4] D.L. Witt-Rose. 'Student self-efficacy in college science: An investigation of gender, age, and academic achievement' Retrieved from http://google.com/students-self-efficay./123.pdf. 26 March, 2019. 2003

[5] M. Cascio, V. Botta and V. Anzaldi. The role of self-efficacy and internal locus of control in online learning. Journal of e-Learning and Knowledge Society, vol. 9 no. 3, pp. 95-106. 2013.

[6] M. C. Romppel, R. Herrmann-Lingen, F. Wachter, H.D. Edelmann, B. Düngen, G. Pieske and F. Grande. 'A short form of the General Self-Efficacy Scale (GSE-6): Development, psychometric properties and validity in an intercultural non-clinical sample and a sample of patients at risk for heart failure' Retrieved from http://GMSPsychosoc10:Doc01. 2013.

[7] J. Lane and A. M. Lane. 'Self-efficacy and academic performance' Social Behaviour and Personality, vol. 29, pp. 687-694. 2001.

[8] A.T. Yazachew. 'Relationship between self-efficacy, academic achievement and gender in analytical Chemistry at Debre Markos college of teacher education' AJCE, vol. 3 no. 1, pp. 3-28. 2013.

[9] S. Rudina (2013) 'The relationship between self-efficacy and academic performance in the context of gender among Albanian students' European Academic Research, no. 1, pp. 467-478.

[10] G. Maria. 'The relationship between self-efficacy and academic achievement in adult learners' Athens Journal of Education, pp. 237-246. 2014.

[11] G. Nworgu 'Educational research: Basic issues and methodology' Ibadan: wisdom Publisher Limited. 2015.

[12] J.W. Santrock 'Psychology of education' Jakarta: Kencana. 2013.

[13] P. R. Pintrich 'The role of motivation in promoting and sustaining self-regulated learning' International Journal of Educational Resolution, vol. 31,, pp. 459–470. doi: 10.1016/S0883-0355(99)00015-4. 2004.

[14] J. Fernandez-Rio, J. A. Cecchini, A. Méndez-Gimenez, D. Mendez-Alonso, and J. A. Prieto 'Self-regulation, cooperative learning, and academic self-efficacy: interactions to prevent school failure' Frontier Psychology, vol. 8, pp. 22-35 doi: 10.3389/fpsyg.2017.0002. 2017.

[15] Ahmad, S., Hussain, A. & Ayeem, M. (2012). Relationship of academic self-efficacy to self-regulated learning, school identification, test anxiety, and academic achievement. International Journal of Education, 4, 12-25.

[16] Bandura A. (1997). Self-Efficacy: The exercise of control. New York, NY: Freeman.