Self-Efficacy and Chemistry Students' Academic Achievement in Senior Secondary Schools in North-Central, Nigeria

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ABSTRACT

Self-efficacy reflects the extent to which students believe that they can successfully perform in school. It usually positively correlated with outcome expectations but it is possible that a student's has high self-efficacy does not transform into a high academic achievement. This study sought to find out the relationship between chemistry students' self-efficacy and their academic achievement in senior secondary schools in North-central, Nigeria. The study is an ex-post facto research and is a descriptive survey. The subjects of the study were one thousand one hundred and fifty (1150) senior secondary school III chemistry students selected from Kogi, Kwara and Niger States of Nigeria. The data collected were analyzed using descriptive and inferential statistics of mean, percentage and Pearson Product Moment Correlation. The findings revealed that no significant relationship existed between self-efficacy and the academic achievement of the chemistry students. The study concludes that students' self-efficacy needs to be complemented with a host of other factors to achieve high academic achievement in Chemistry. It is therefore recommended that attention be paid to other factors necessary for better students' achievement in chemistry to complement students' high self-efficacy, so that a combination of these factors could result in high academic achievement in Chemistry

Keywords: ***Self-efficacy, Chemistry Students, Academic Achievement, Senior Secondary Schools, Nigeria.***

INTRODUCTION

Self-efficacy is defined as one's belief in his/her capacity to perform a specific action successfully (Bandura, 1997, 2001). Self-efficacy determines how people feel, think, motivate themselves and behave. Such beliefs produce these diverse effects through four major processes, which include cognitive, motivational, affective and selection processes. A strong sense of efficacy enhances human accomplishment and personal well-being in many ways, such as academic achievement.

Students might have different self-efficacy judgments in different types of tasks or domains. For instance, a student who feels efficacious in biology might not feel that efficacious in chemistry. Self-efficacy influences people's choice of tasks, showing effort and persistence at the task, and thus, is a better predictor of performance and motivation compared to other variables (Bandura, 1997). Similarly, Hampton and Mason (2003); Multon, Brown and Lent (1991); Pajares and Miller (1994); Shell, Colvin and Bruning (1995); Kupermintz (2002); Pintrich and Schunk (2002); Britner (2008); Kiran and Sungur (2011) have affirmed the relationship between self-efficacy and students' achievement. According to Schunk (1985), self-efficacy

beliefs mediate the effects of prior achievement, knowledge and skills on subsequent achievement. For instance, in schools, students with high self- efficacy tend to choose more challenging tasks, show more effort, and do not give up easily, which explains why students of similar ability can have different academic achievement (Bandura, 1997).

Efficacious students look for new challenges, show persistence at tasks and have the ultimate success (Britner, 2008; Zeldin & Pajares, 2000). Even though such students have prior difficulties, the belief in their capabilities to overcome these difficulties results in the motivated performance (Bandura, 1986; Schunk, 1985). Studies have shown that science self-efficacy is associated with science achievement and science-related choices across grade levels (Britner, 2008). Andrew (1998) also found out that science self-efficacy predicted achievement at the college level. Among high school students, science self-efficacy was found to be a good predictor of achievement and engagement with science-related activities than gender and parental background (Kuperminty, 2002; Lau & Roeser, 2002; Lodewyk & Winne, 2005).

As a science subject, Chemistry is concerned with the study of composition and properties of natural substances. It occupies a pivotal position in science and technology and is needed by everybody and in every aspect of human endeavor (Agwagah & Harbor-Peters, 1994; Akinsola, Tella & Tella, 2007; Olayemi, 2009; Abubakar & Eze, 2010). For instance, human beings have used organic compounds and their reactions for thousand of years in the manufacture of many valuable products for men use e.g. soap, oils, hydrogenated oil, kerosene, petrol, plastic, lubricants, vaseline, ceramics and detergents. More so, the ancient Egyptians used organic compounds (indigo and alizarin) to dye cloths which are products of scientific discovery. Chemistry is regarded as the hub of science and it is considered as a service subject (Bajah, 1997). Chemistry is the catalyst for sustainable national growth and development.

In spite of the central position of chemistry among science subjects and its importance in sustaining sustainable economic growth and development, the performance of Nigerian candidates in School Certificate Chemistry over the years is not encouraging (Figure 1).

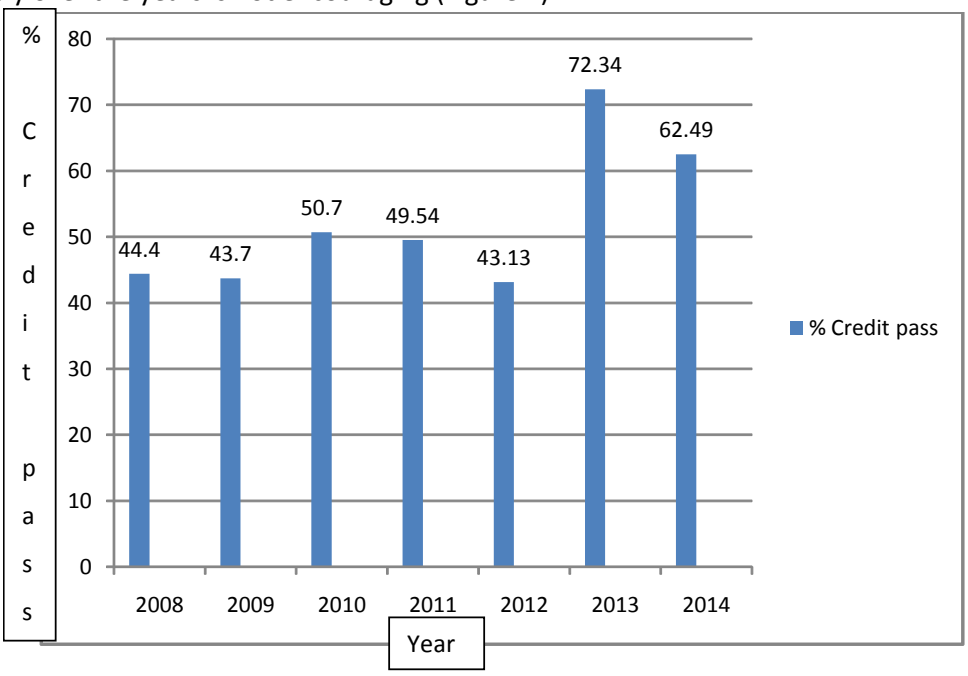

Figure 1: Performance of Nigerian students in the Chemistry in the May/June School Certificate Examinations conducted by the West African Examinations Council between 2008 and 2014. (Source: Statistics Division, West African Examinations Council (WAEC), National Head Office, Yaba, Lagos, Nigeria).

Figure 1 shows that during the percentage credit pass was less than 50% for most of the years reviewed. In 2013, the performance improved but slid back again in 2014. Self-efficacy researchers typically assume that students' belief in their ability to succeed in chemistry tasks, courses, or activities, or their sense

of self-efficacy, has a powerful impact on their choices of science-related activities, the effort they expend on those activities, the perseverance they show when encountering difficulties, and the ultimate success they experience (Bandura, 1997; Britner & Pajares, 2006; Zeldin & Pajares, 2000; Pintrich & Schunk, 2002). Could the dismal performance of Nigerian candidates in School Certificate Chemistry be traceable to their self-efficacy? It is on the basis of the preceding paragraphs that this study was conducted to find out the relationship between students' self-efficacy and their academic achievement in chemistry in North-Central Nigeria which include Benue, Kogi, Kwara, Nasarawa, Niger, and Plateau states as well as the Federal Capital Territory (FCT).

THEORETICAL FRAMEWORK

Self-efficacy is largely grounded in the social cognitive theory. This theory explains that human functioning results from interactions among personal factors (e.g., cognitions, emotions), behaviors and environmental conditions (Bandura, 1986, 1997). From this perspective, self-efficacy affects one's behaviors and the environments with which one interacts and is influenced by one's actions and conditions in the environment. Self-efficacy is hypothesized to affect individuals' task choices, effort, persistence and achievement (Bandura, 1997; Schunk, 1995). Compared with learners who doubt their capabilities, those who feel self-efficacious about learning or performing a task competently are apt to participate more readily, work harder, persist longer when they encounter difficulties and achieve at higher levels.

Learners acquire self-efficacy information from knowledge of others' performances through social comparisons. Similar others offer the best basis for comparison. Students who observe similar peers learn a task may also believe that they can learn it. Such vicarious information typically has a weaker effect than actual performance because vicariously-induced self-efficacy can be negated by subsequent performance failure.

Some researchers such as Pajares and Schunk (2001) and Usher and Pajares (2006) have reported that students' beliefs in their abilities to achieve desired goals strongly influence their academic achievement. In view of this Finn and Frone (2004) concluded that academic self-efficacy reflects the extent to which students believe that they can successfully perform in school. Self-efficacies are usually positively correlated with outcome expectations but it is possible that a student has high self-efficacy but low expectations about the grades earned from the examinations (Pintrich & Schunk, 1996).

Self-efficacy beliefs develop as a result of information from four types of resources: mastery (enactive) experiences, vicarious experiences, verbal persuasion and physiological states. Mastery or enactive experiences are derived from what one has experienced are said to be the most forceful reference of self-efficacy beliefs. Vicarious experiences are gained by observing a model's performance and comparing it with the observer. A comparatively weak source of self-efficacy is the persuasion like 'I have faith in you' given by others. The last source of students' self-efficacy is physiological reactions which are stress, anxiety and other feelings seen as signs of physical incompetence (Bandura, 1997).

Self-efficacy beliefs are domain specific and refer to perceptions of capabilities to learn or perform given tasks within specified domains (Pajares, 1996). In gauging self-efficacy, people assess their skills and capabilities to translate those skills into actions. Possessing skill can raise self-efficacy, which in turn can lead to further skill acquisition, but skill and self-efficacy are not synonymous in meaning. Students' own performances offer the most reliable guides for gauging self-efficacy. In general, success raises self-efficacy and failures lower it, although an occasional failure after some successes is unlikely to have much impact. How people act can often be predicted better by their self-efficacy (i.e. the beliefs about their capabilities) than by their actual skills (Bandura, 1986). Self-efficacy also depends on students' intelligence and abilities. In general, high-ability students feel more efficacious about performing well than do low-ability students, but self-efficacy is not necessarily a direct reflection of students' intelligence and abilities.

Purpose of the Study

The main purpose of this study was to determine the relationship between self-efficacy and chemistry students' academic achievement in North-central, Nigeria. Specifically, the study determined:

i. the level of academic achievement of senior school chemistry students in North-central, Nigeria.
ii. the level of chemistry students' self-efficacy in senior schools in North-central, Nigeria.
iii. the relationship between students' self-efficacy and their academic achievement in chemistry.

Research Questions

The study provides answers to the following questions:

i. What is the level of the academic achievement of senior school chemistry students in North-central, Nigeria?
ii. What is the level of chemistry students' self-efficacy among senior schools in North-central, Nigeria?
iii. Is there any relationship between senior school chemistry students' self-efficacy and their academic achievement in chemistry?

Research Hypothesis

HO_1: There is no significant relationship between self-efficacy and academic achievement of senior school chemistry students in North-central, Nigeria.

RESEARCH METHODOLOGY

The study is a research conducted via a descriptive survey. The population for the study comprised all the chemistry students in the senior school three (SS3) in North-central, Nigeria. Four hundred chemistry students were selected by stratified random sampling from ten secondary schools in Kogi, Kwara and Niger States which made up of 1200 chemistry students and thirty secondary schools altogether in which one thousand one hundred and fifty chemistry students duly completed the questionnaire for the study.

Two instruments were used for the study. The first one was a researcher-designed questionnaire named students' self-efficacy questionnaire (SEQ) adapted from Bandura (1986). The modification of the questionnaire involved changing the response modes to the questions in the questionnaire from Very True (VT), True (T), Untrue (U) and Not At All (NAA) to Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) respectively, in the believe that the response modes better represent respondents' personal opinions. The change in the response modes necessitated the transformation of the questions which make up the questionnaire items into statements. The responses were scored 4, 3, 2 and 1 respectively.

The items investigate the confidence which students had in undertaking different tasks in chemistry. The questionnaire was validated by three lecturers in the Department of Science Education, University of Ilorin, Nigeria for item structure and language clarity. The reliability of the questionnaire was determined using a test-retest method of two weeks interval, in which the questionnaire was administered to thirty chemistry students from another school not covered by the main study. The data obtained was subjected to Pearson Product Moment Correlation. A calculated reliability coefficient of 0.72 was obtained.

The second instrument was the Chemistry result of the respondents in the Joint Mock School Certificate Examination jointly conducted by all states in North-Central Nigeria. The Joint Mock School Certificate Examination questions were normally taken through the basic processes of validation and reliability before they were administered. Hence, the examination questions were deemed valid and reliable.

Copies of the questionnaire were directly administered to the students in each of the schools and retrieved same day the school was visited. The data obtained were subjected to statistical analysis using frequency counts, mean, standard deviation, and Pearson Product Moment Correlation was employed to test the only hypothesis.

DATA ANALYSIS AND RESULTS

The data obtained are presented and explained as follows:

Research Question 1: What is the level of the academic achievement of senior school chemistry students in North-central, Nigeria?

The results obtained in respect of this research question are presented on table 1.

Table 1: Students' grades in Chemistry in the Joint Mock Examinations conducted by states, in North-Central, Nigeria in 2012.

States	Grades									Total
	A1	B2	B3	C4	C5	C6	D7	E8	F9	
Kwara	4	3	5	11	28	36	50	49	214	400
Kogi	26	6	14	32	44	88	66	50	74	400
Niger	2	39	47	59	53	62	43	23	22	350
Total	32	48	66	102	125	186	159	122	310	1150

Source: State Ministries of Education.

Table 2: Description of Chemistry Students' Grades in Joint Mock Examinations in Kogi, Kwara and Niger States, Nigeria.

Grade	Frequency	Percentage	Cumulative percentage
A1	32	2.8	2.8
B2	48	4.2	7.0
B3	66	5.7	12.7
C4	102	8.9	21.6
			Continued
C5	**125**	**10.9**	**32.4**
C6	186	16.2	48.6
D7	159	13.8	62.4
E8	122	10.6	73.0
F9	310	27.0	100.0
Total	1150	100	

Mean score is 49.39

Tables 1 and 2 show the level of Chemistry students' academic achievement in the Joint Mock Examinations conducted in Kogi, Kwara and Niger States, Nigeria. The result shows that only 559 (48.61%) of the respondents from Kogi, Kwara and Niger states passed at the credit level. It could be concluded that the level of academic achievement of chemistry students is low because the percentage score at credit level was

less than 50%. The 48.61% was obtained from the addition of frequency from A1-C6 grade levels on table 2 and divided by the total frequency multiplied by one hundred i.e. 556 divided by 1150 multiplied by 100.

Research Question 2: What is the level of students' self-efficacy among senior school chemistry students in North-central, Nigeria? The data obtained in respect of this research question are presented on table 3.

Table 3: Summary of ranks of students' self-efficacy mean scores among senior school chemistry students in North-central, Nigeria.

Item No	Items	Mean	Rank	Self-efficacy
83	I like explaining difficult topics in chemistry to other students	2.92	1st	High
81	I always obtain good grade in chemistry test and examinations.	2.85	2nd	High
90	I find it easy to explain the main ideas of public lectures on chemistry.	2.85	2nd	High
85	I find it easy to explain the main ideas of public lectures on chemistry.	2.83	4th	High

Continued

89	**I easily apply theories learnt in chemistry class to laboratory practical work.**	**2.83**	**4th**	**High**
86	I learn chemistry without fear.	2.82	6th	High
80	I conveniently talk to scientists about chemistry.	2.82	6th	High
82	I am always in need of my chemistry teacher to supervise me during practical class.	2.78	8th	High
88	I always get high grades in essay part of Chemistry questions during the examination	2.77	9th	High
84	I easily get an appropriate formula to solve Chemistry problems.	2.74	10th	High
87	I easily write out the summary of a television documentary that deals with chemistry.	2.72	11th	High

Table 3 presents data on the level of students' self-efficacy among senior secondary school chemistry students. The obtainable scores for the response modes of strongly disagree, agree disagree and strongly agree are 1, 2, 3 and 4 respectively, making 4 the maximum obtainable mean score for each of the items in the questionnaire. Self efficacy was then graded at three levels:

Low: 0-1.4
Average: 1.5 – 2.4
High: 2.5-4.0

The table shows that all the eleven items were ranked high with the mean scores ranging from 2.92 to 2.72. This means that all chemistry students in the study had high self-efficacy.

Research Question 3: Is there any relationship between senior school chemistry students' self-efficacy and their academic achievement in chemistry?

The corresponding hypothesis to research question 3 is hypothesis 1.

HO_1: There is no significant relationship between self-efficacy and academic achievement of senior school chemistry students in North-central, Nigeria.

The data obtained in respect of the question and the hypothesis is presented on table 4.

Table 4:Summary of Pearson Product Moment Correlation Coefficient between self-efficacy and academic achievement of senior school chemistry students in North-central, Nigeria.

Variables	No	Mean	SD	df	Calculated r	p-value
Students' self-efficacy	1150	30.40	6.415			
				1148	.038	.200
Academic achievement	1150	49.39	12.480			

Not sig. at P> 0.05

Table 4 shows [r (1148, 0.05) =0.200]. Therefore, the null hypothesis was not rejected. This suggests that there was no significant relationship between self-efficacy and chemistry students' academic achievement in chemistry in North-central, Nigeria.

SUMMARY OF FINDINGS

From the findings of this study, it could be summarized that:

1. the academic achievement of the respondents from Kogi, Kwara and Niger States was low.
2. the chemistry students' self-efficacy in the three states under the study was high.
3. there was no significant relationship between self-efficacy and chemistry students' academic achievement in chemistry in North-central, Nigeria.

DISCUSSION

The outcome of this study indicates that chemistry students in senior secondary schools in North-central Nigeria had a low level of academic achievement in the Joint Mock Chemistry Examination, as only 559 (48.61%) of the respondents passed at credit level. This is in spite of the fact that the result presented on table 3 shows that all the respondents had high self-efficacy in learning chemistry. This finding contradicts that of Britner (2008) and Kiran and Sungur (2011) who also reported high students' self-efficacies in their studies, but which produced a corresponding high level of academic achievement in Chemistry. The finding is also not in agreement with those of Kupermintz (2002), Lau and Roeser (2002) and Lodewyk and Winne (2005) who reported that science self-efficacy were a better predictor of achievement and engagement with science related activities among high school students. It appeals to common sense that a high self-efficacy should produce a corresponding high academic achievement in learners, but the outcome of this study has indicated that this may not happen all the time. The differences observed in the outcome of this particular study and those of others could be due to the influence of other variables that contribute to students' achievement complementing self-efficacy in their own study but not in this particular study.

CONCLUSION

In this study, it was found out that students' level of academic achievement in chemistry in North-Central, Nigeria was low. Yet, their self-efficacy was high. It was also found out that there was no significant relationship between the students' self efficacy and their academic achievement. Hence, it could be concluded that the academic achievement of the students could not be ascribed to their self-efficacy alone as other factors contribute to the achievement of students in chemistry. The outcome of this study suggests that no matter how self-efficacious students are, it may not have any significant impact on students' achievement in chemistry if other crucial factors to the proper learning of chemistry are left unattended.

RECOMMENDATIONS

Since the outcome of this study has indicated that, self-efficacy alone cannot impact significantly on students' achievement in chemistry; attention should be paid to other factors necessary for better students' achievement in chemistry. Such factors like provision of adequate laboratory materials, recruitment of qualified teachers, provision of conducive classroom environment etc should be taken much more seriously so that these can be complemented with the high self-efficacy of the students to produce a better achievement of students in chemistry.

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