SELF-EFFICACY AND ATTRIBUTION STYLES AS PREDICTORS OF CHEMISTRY ACHIEVEMENT AMONG SECONDARY SCHOOL STUDENTS IN IMO STATE

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Abstract
This paper investigated self-efficacy and attribution styles as predictors of chemistry achievement among secondary school students in Imo State. Three research questions and three hypotheses guided the study. The study adopted a predictive correlational survey research design. The population of this study comprised all senior secondary school Chemistry students in 295 public secondary schools in all the six education zones in Imo State. Eight hundred and seventy five (875) students formed the sample of this study which were selected using multi-stage random sampling technique. Three instruments were used
to collect data for this study, namely; Morgan-Jinks Student Self-Efficacy Scale (MJSSES), The Attribution Scale for Students (ASS), and a Chemistry Achievement Proforma (CAP). The Cronbach reliability coefficient for MJSSES and ASS yielded 0.81 and 0.71 respectively. The data collected from respondents were statistically analyzed using multiple regression analysis via SPSS version 20. The results revealed that self-efficacy and attribution styles individually and jointly related insignificantly with students’ chemistry achievement. Although, these predictions were weak. These variables contributed little to the variance observed in chemistry achievement of secondary school students. This indicates that other factors are contributing more to students’ achievement in chemistry other than their self-efficacy and attribution styles. It was recommended among others that there should be continuous public enlightenment campaign on the importance of self-efficacy and attribution styles by all stakeholders.

**Keywords:** Chemistry, Achievement, Self-efficacy, Attribution Styles, Predictors

**Introduction**
Chemistry is a branch of science that finds applications at home and industry. According to Akpan (2016), chemistry is the study of matter and the changes that matter
undergoes. It is a branch of science which deals with the study of the nature, composition and properties of matter and the changes matter will undergo under different conditions. Chemistry is an experimental science whose study involves exploration of relationship between theory and experiment (Otor, 2013). The study of chemistry as a subject at the secondary school level helps students in developing basic science skills, knowledge and attitude-based competences required for problem solving in their environment. Therefore, a poor foundation in chemistry at the secondary school level may jeopardize future achievement in the subject (Kan & Akbas, 2016). One of the major variables that measure an individual’s success or failure in chemistry is academic achievement. Academic achievement is often cognitive based and measured by examination or continuous assessment.

The factors that affect academic achievement in chemistry have been identified by scholars. According to Usman and Memeh (2012), the factors that negatively affect chemistry achievement include students’ backgrounds, their self-efficacy, lack of interest and negative attitude towards chemistry. Teacher related factors like poor teacher preparation, inadequate teacher qualification, inadequate instructional materials and adoption of poor teaching methods also play a role. In Nigeria, efforts are being made by researchers, government and non-governmental organizations to improve cognitive outcomes among
chemistry students. Some of these efforts include organization of conferences, seminars and workshops for both students and teachers, organization of quizzes for students as a motivational approach to learning, equipping the laboratory with modern laboratory equipment’s and facilities etc. As available evidence indicates, achievement in chemistry at the secondary school level remains low and unimpressive (Viko, 2010). Factors that influence students’ chemistry achievement at the senior secondary school are multivariate. Among the factors that have been identified to be responsible for low achievement in chemistry are teachers’ qualification, quality of instruction and attitude, social psychological factors and social environmental factors (Udoh, 2008). Among the factors affecting students achievement in general, less attention has been paid to student’s self-efficacy and attribution styles (Busari, 2010). These are the factors under focus in this study because much attention has already been paid on ameliorating the effects of such factors related to teaching method, materials, environmental and other teacher-related factors yet students achievement in chemistry has remained low. The present researcher is poised to divert attention to such social psychology based factors as self-efficacy, attribution styles and see how these predict chemistry students’ achievements.

Self-efficacy is the belief in one’s own capacity to organize and execute the courses of action required to
manage prospective situation (Stajkovic & Luthans, 2008). Studies show that one’s own beliefs of efficacy is an important determinant of motivation that affect thought and action. Since achievement in chemistry is both cognitively and psychomotor-based, it is possible that it can be affected by a student self-efficacy.

Attribution style is another important variable often related to academic achievement (Moskowitz, 2015). Naturally, human beings are in constant search for the factors that cause them or other people to behave the way they do. The process of assigning causes to people’s behaviour is called attribution. This is collaborated by Wade and Tavris (2010) who defined attribution as a process by which people are motivated to explain their own or others’ behaviours by pointing at causes of those behaviours to a situation or disposition. However, when one makes dispositional attribution, the action (poor achievement) is regarded as being caused by something in the person such as motive, effort or ability. A student with dispositional attribution can explain his/her achievement in chemistry test as due to his/her inadequate preparation for the test. Consequently, ability or inability of a chemistry student to understand and explain the causes of his or her poor achievement properly will definitely affect his future actions. This is why the present researcher thinks that studying chemistry student’s attribution styles
may be key to understanding their achievement in the subject.

Most studies done in Nigeria in this area concentrated on the relationship existing between self-efficacy and one or two variables (Adeyemo & Torubeli, 2008; Onyeizugbo, 2010; Kan & Akbas, 2016). Such variables include self-concept, peer influence, attribution styles, and anxiety and so on. They failed to show the relative and combined contribution of self-efficacy, and attribution styles (success and failure). No study however has been found by this researcher in Nigeria that sought the extent to which self-efficacy, attribution styles (effort, luck and teacher) and academic achievement among secondary school students in chemistry.

**Statement of the Problem**
The study of Chemistry as a subject at the secondary school level helps students in developing basic science skills, knowledge and competence required for problem solving in their environment. It is observed that secondary school students in Nigeria perform very poorly in Chemistry yearly. The dismal achievement of students in Chemistry over the years is a cause of serious concern. WAEC Chief Examiner’s Report (2012-2017) showed consistent poor academic achievement of students in Chemistry over a period of six years. In reference to 2012 WAEC May / June Exam, the raw mean score of 30 and
standard deviation of 13.89 was poorer than 2011 WAEC May / June exam with a raw mean score of 32 and standard deviation of 18.39 and so on (www.waeconline.org.ng). Efforts have been made by educational researchers to improve students’ academic achievement especially in chemistry but adequate attention has not been paid to the affective components of learners such as perceived self-efficacy and attribution styles. The problem of this study, therefore, is the perennial poor academic achievement of secondary school students in chemistry despite robust efforts of teachers and researchers for an improvement. This could be due to the fact that the impact of affective components of learners such as self-efficacy and attribution styles on their academic achievement in the subject have not been examined. Therefore, this study on self-efficacy and attribution styles as predictors of chemistry achievement among secondary school students in Imo State is considered imperative.

**Research Questions**

The study provides answers to the following research questions:

1. What is the extent to which self-efficacy predicts chemistry achievement of secondary school students in Imo State?
2. To what extent does attribution styles (success and failure) of secondary school students predict their chemistry achievement?
3. To what extent do the two variables jointly predict to students’ chemistry achievement?

Hypotheses

The following hypotheses were tested at 0.05 alpha level:
1. Self-efficacy significantly predicts chemistry achievement of secondary school students in Imo State?
2. Attribution styles (success and failure) of secondary school students predict their chemistry achievement?
3. Self-efficacy and attribution styles do not significantly predict students’ chemistry achievement?

Method

The study adopted a correlational survey research design. The study was carried out in Imo State. The population of this study comprised all senior secondary school Chemistry students in 295 public secondary schools in all the six education zones in Imo State. Eight hundred and seventy five (875) formed the sample of this study which were selected using multi-stage random sampling technique. Four instruments were used to collect data for this study. These instruments are Morgan-Jinks Student Self-Efficacy Scale (MJSSES) (1999), The Attribution Scale for Students (ASS) developed by Shumow and
Schmidt (2013), and Chemistry Achievement Proforma. The Morgan-Jinks Student Self-Efficacy Scale and Attribution Scale were adapted in this study based on some modifications and were subjected to expert validation). The Morgan-Jinks Student Self-Efficacy Scale (MJSSES) instrument has a total of 30 items on a four scale response format: really disagree (4), kind of agree (3), kind of disagree (2) and really agree (1). The Attribution Scale for Students (ASS) has 22 items on a four scale response format ranging from Usually (U) = 4; Sometimes (S) = 3; Rarely (R) = 2 and Never = 1. MJSSES and ASS were adapted in this study based on some modifications. They were equally subjected to expert validation in the field of science education and measurement and evaluation.

The Cronbach reliability coefficient for MJSSES and ASS yielded 0.81 and 0.71 respectively. The data collected from respondents were statistically analyzed using multiple regression analysis via SPSS version 20.
Results

Table 1: Beta Coefficients for Self-efficacy and Chemistry Achievement

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>Beta</th>
<th>$R^2$</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>(constant)</td>
<td>57.614</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>.036</td>
<td>.020</td>
<td>.0004</td>
<td>Poor predictor</td>
</tr>
</tbody>
</table>

Table 1 reveals that academic self-efficacy had positive linear relationships with chemistry achievement given by Beta = .02. From the analysis, academic self-efficacy belief contributed just 0.04% of variance in chemistry achievement ($R^2 = .04$). The implication of this is that high self-efficacy belief would lead to little increase in students’ chemistry achievement.
Table 2: Beta Coefficients for Effort, Luck and Teacher on Chemistry Achievement

<table>
<thead>
<tr>
<th>Attributions of Success</th>
<th>B</th>
<th>Beta</th>
<th>$R^2$</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>56.290</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-effort</td>
<td>-.655</td>
<td>-.168</td>
<td>.028</td>
<td>Poor predictor</td>
</tr>
<tr>
<td>Luck</td>
<td>1.794</td>
<td>.211</td>
<td>.045</td>
<td>Poor predictor</td>
</tr>
<tr>
<td>Teacher</td>
<td>2.422</td>
<td>.285</td>
<td>.081</td>
<td>Poor predictor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attributions of Failure</th>
<th>B</th>
<th>Beta</th>
<th>$R^2$</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-effort</td>
<td>-1.011</td>
<td>-.259</td>
<td>.067</td>
<td>Poor predictor</td>
</tr>
<tr>
<td>Luck</td>
<td>.151</td>
<td>.020</td>
<td>.0004</td>
<td>Poor predictor</td>
</tr>
<tr>
<td>Teacher</td>
<td>.009</td>
<td>.003</td>
<td>.000009</td>
<td>Poor predictor</td>
</tr>
</tbody>
</table>

Note. N = 869; B= beta coefficient.

Results presented in Table 2 show that self-effort with (Beta = -.168) is a negative predictor of chemistry achievement and contributed just 2.8% of variance in chemistry achievement ($R^2 = .028$). The implication of this is that the more students attribute their success to self-effort, the more they achieve poorly. Also, the results indicate that luck attribution style with (Beta = .211) is a positive predictor of chemistry achievement and contributed 4.5% of variance in chemistry achievement ($R^2 = .045$); implying that the more students attribute their success to luck, the less they achieve poorly. More so, the
results show that attributing success to teacher is positive predictor of chemistry achievement and accounted 8.1% of variance in chemistry achievement (Beta = .285; $R^2 = .081$). The researcher went further to investigate the predictive values of each of the three domains of attribution styles (to failure) on chemistry achievement. The coefficients for the model show that self-effort is a negative predictor of chemistry achievement and contributed 6.7% of variance in chemistry achievement (Beta = -.259; $R^2 = .067$), attributing failure to luck is a positive predictor and contributed 0.04% (Beta = .020; $R^2 = .0004$) while attributing failure to teacher and contributed 0.0009% of variance in chemistry achievement (Beta = -.003; $R^2 = .000009$).

Table 3: Multiple linear regression analysis among the predictor variables

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R-Square</th>
<th>Adjusted R-Square</th>
<th>% contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.134a</td>
<td>.018</td>
<td>.010</td>
<td>1.8</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Self-efficacy, Attribution style (self-effort, luck, teacher)

Table 3 presents a summary of the multiple regression analysis among the predictor variables when combined together. The result shows that the three variables positively predicted chemistry achievement ($R = .134$).
Working together, the three variables accounted for 1.8% of the total variance in chemistry achievement ($R^2 = .018$).

**Test of Hypothesis**

**Table 4: Significant Prediction of Self-efficacy on Chemistry Achievement**

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>Beta</th>
<th>T</th>
<th>Sig.</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>(constant)</td>
<td>57.614</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>.036</td>
<td>.020</td>
<td>.568</td>
<td>.570</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

From the result of the regression analysis as shown in Table 4, the statement of hypothesis 1 is accepted; showing that self-efficacy beliefs of secondary school students do not significantly predict their chemistry achievement scores. This is because the p-value (Sig. = 0.570) is greater than the 0.05 level of significance.
Table 5: Significant Prediction of Attribution on Chemistry Achievement

<table>
<thead>
<tr>
<th>Attribution Styles</th>
<th>B</th>
<th>Beta</th>
<th>T</th>
<th>Sig.</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>56.290</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-effort</td>
<td>-.655</td>
<td>-.168</td>
<td>-.963</td>
<td>.336</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Luck</td>
<td>1.794</td>
<td>.211</td>
<td>1.210</td>
<td>.227</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Teacher</td>
<td>2.422</td>
<td>.285</td>
<td>1.438</td>
<td>.151</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

**Attribution of Failure**

<table>
<thead>
<tr>
<th>Attribution Styles</th>
<th>B</th>
<th>Beta</th>
<th>T</th>
<th>Sig.</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-effort</td>
<td>-1.011</td>
<td>-.259</td>
<td>-1.232</td>
<td>.218</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Luck</td>
<td>.151</td>
<td>.020</td>
<td>.540</td>
<td>.589</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Teacher</td>
<td>.009</td>
<td>.003</td>
<td>.080</td>
<td>.936</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

From the result of the regression analysis as shown in Table 5, the statement of hypothesis 2 is accepted; showing that attribution styles (self-effort, luck and teacher) scores of secondary school students do not significantly predict their chemistry achievement scores. This is because the p-values are greater than the 0.05 level of significance.
From the result of the regression analysis as shown in Table 6, the statement of hypothesis 3 is rejected; showing that self-efficacy belief, attribution styles (self-effort, luck and teacher) and test anxiety of secondary school students significantly predict their chemistry achievement scores. This is because the p-value is less than the 0.05 level of significance ($F = 2.233; \text{Sig.} = 0.030, p < 0.05$).

**Discussion**

Findings of the study revealed that academic self-efficacy positively predicted chemistry achievement. This implies that an increase in self-efficacy would lead to increased students’ chemistry achievement. From the findings of the regression analysis, the statement of hypothesis 1 is accepted; showing that self-efficacy beliefs of secondary school students do not significantly predict their chemistry achievement. The positive relationship found between self-efficacy and chemistry achievement is not surprising because students with a high sense of efficacy are more likely to challenge themselves with difficult tasks and be
intrinsically motivated. These students will invest a high degree of effort in order to meet their commitments. Students with low self-efficacy, on the other hand, believe they cannot be successful and thus are less likely to make a concerted and extended efforts and may consider challenging tasks as threats that are to be avoided. Thus, students with low self-efficacy have low aspirations which may result in low academic achievement.

This result is in agreement with Christensen et al (2012) who found that self-efficacy beliefs are positively related to and influence achievement in accounting. Researchers have reported that mathematics self-efficacy is a good predictor of mathematics interest and choice of mathematics related courses (Lunenburg, 2011). In another study, Onyeizugbo (2010) reported that high self-efficacy seemed to influence academic persistence necessary to maintain high academic achievement. Research findings have suggested that learners who posses’ high self-efficacy achieves better in their academic endeavour (Viko, 2010). However, there were also few researches (Kador, 2011; Kaitlyn & Philip, 2013) that did not support such an argument. Kaitlyn and Philip (2013) reported that academic achievement is unpredictive of self-efficacy. This goes to show that even though self-efficacy related positively with students’ achievement in chemistry, the relationship is not significant. This means that one cannot use knowledge of students’ self-efficacy to
predict what their achievement in chemistry would likely be. This study therefore suggests the need to help secondary school students overcome every problem associated with self-efficacy. Such help and effort, by parents and teachers, will go a long way to increasing students’ achievement in chemistry and at the same time help students to believe in their own capability.

Findings showed the attribution styles of secondary school chemistry students. The result revealed that majority of the students attribute both their success and failure to self-effort. Results show that self-effort is a negative predictor of chemistry achievement and contributed little to the variance in chemistry achievement. Also, the results indicate that luck attribution style is a positive predictor of chemistry achievement and contributed little to the variance in chemistry achievement; implying that the more students attribute their success to luck, the less they achieve poorly. More so, the results showed that attributing success to teacher is positive predictor of chemistry achievement and accounted more to the variance in chemistry achievement. The analysis further revealed the predictive values of each of the three domains of attribution styles (to failure) on chemistry achievement. The coefficients for the model showed that self-effort is a negative predictor of chemistry achievement and contributed little to the variance in chemistry achievement, attributing failure to luck is a positive predictor and
contributed little while attributing failure to teacher and contributed little or nothing to the variance in chemistry achievement. The implication of this is that the more students attribute their success to self-effort, the more they achieve poorly. From the finding of the regression analysis, the statement of hypothesis 2 is accepted; showing that attribution styles (self-effort, luck and teacher) scores of secondary school students do not significantly predict their chemistry achievement scores. This is so because attribution is concerned with the thoughts people have about events or situations and what causes them, which offers us one method for understanding human behaviour. Specifically, an attribution is an expression of the way a person perceives the relationship between a cause and an outcome. Students, when given a learning task, refer to several resources to determine how they study the task, how they estimate their success, how much effort and time will they invest on the task. The result of this evaluation process relies on students’ cognitions and motivational beliefs.

Several researchers who have studied academic achievement have reported that one of the most successful predictors of academic achievement has been attribution style. Okonkwo (2015) investigated attribution style as correlates of student’s academic achievement in chemistry. The result indicates that students do not believe in achieving success through effort /ability rather they
believe in external forces such as teachers, luck, miracle centres and others for their academic pursuit. However, encouraging students to be attributing their success or failure to internal factors rather than externals because internal attribution increases student’s effort in their academic achievement was recommended. The finding also collaborated with the results of Sukariyah and Assaad (2015) who explored the effect of attribution retraining on high school students’ academic performance in mathematics. The results demonstrated the positive effect of attribution retraining on students’ academic achievement in mathematics and their attribution styles.

The previous research into the relationship between attributions and academic performance has produced contradictory findings that have not been resolved. This could be as a result of poor and insignificant prediction of attribution styles of students and their chemistry achievement found, which indicates that an increase in attribution style would lead to small increase in students’ chemistry achievement. This by implication goes to show that knowledge of students’ attribution styles cannot predict actually what their achievement in chemistry would likely be. However, Dweck (2015) indicated that encouraging students to attribute their poor performance to unstable causes resulted in both improved effort and performance. She reasoned that students who view their intelligence as a stable trait react to failure very differently
from students who view their intelligence as unstable. Therefore, students’ understanding of their attribution styles may help them improve their academic performance. This process can be done through attribution retraining programs. These programs attempt to enhance motivation by altering students’ attributions for successes and failures.

The findings of this study presents a summary of the multiple regression analysis among the predictor variables when combined together. The result shows that the three variables positively predicted chemistry achievement. Working together, the two variables accounted little to the total variance in chemistry achievement. From the result of the regression analysis, the statement of hypothesis 3 is rejected; showing that self-efficacy belief and attribution styles (self-effort, luck and teacher) of secondary school students significantly predict their chemistry achievement scores when working together. This is in accordance with Rizwan and Nasir (2010), Kaitlyn and Philip (2013) and Syokwaa et al (2014) who reported similar results earlier. This indicates that other factors are contributing more to students’ achievement in chemistry other than their combined self-efficacy and attribution styles. This by implication goes to show that knowledge of students’ self-efficacy and attribution styles cannot jointly predict what their achievement in chemistry would likely be. This is attested to by the beta coefficients of the multiple
regression analysis. This suggests the need to help secondary school students overcome every problem associated with these variables. Such help and effort, by parents and teachers, will go a long way to increasing students’ achievement in chemistry and at the same time help students to belief in their own capability, attribute their success or failure to internal factors. This is so because academic achievement is a factor found among students and it is a function of many factors, some of which are within the student and the classroom while others are out of the classroom while academic objectives are paramount to students’ success in school attainment, goal commitment is sensitive to factors like self-efficacy and attribution styles.

**Implications**
The findings of the study have implications for science education and curriculum planning in Nigeria. For one thing, the study has provided empirical evidence to support the fact that self-efficacy and attribution styles individually and jointly related insignificantly with students’ chemistry achievement. Although, these relationships are weak irrespective of students’ gender. Self-efficacy and attribution styles related positively with students’ achievement in chemistry. These variables contributed little to the variance observed in chemistry achievement of secondary school students.
Another implication is that research needs to be conducted to confirm these findings and to investigate whether they have any implications for working with chemistry students to improve their academic achievement. Finally, practical research needs to be done to develop and assess programs for counselors, teachers and school administrators to use on an individual, in the classroom and on institutional level respectively.

**Conclusion**
Based on the findings of the study, it was concluded that the self-efficacy and attribution styles individually and jointly related insignificantly with students’ chemistry achievement. Although, these relationships were weak irrespective of students’ gender. Self-efficacy and attribution styles related positively with students’ achievement in chemistry. These variables contributed little to the variance observed in chemistry achievement of secondary school students. However, an increase in self-efficacy or attribution would lead to increased students’ chemistry achievement. This indicates that other factors are contributing more to students’ achievement in chemistry other than their self-efficacy and attribution styles.

**Recommendations**
Based on the findings of the study, the following recommendations are made:
1. There should be continuous public enlightenment campaign on the importance of self-efficacy and attribution. This enlightenment campaign should be carried out at the national, state and local government levels by the ministry of education.

2. Chemistry teachers should be sponsored on seminar and conferences associated with psychological constructs (self-efficacy and attribution styles by the government so as to encourage the students to develop high efficacy level.

3. Teachers should be trained by school management authorities on the strategies which are related to the self-efficacy and attribution styles so as to help students to increase their efficacy

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