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. MOTIVATION AND ACADEMIC RESILIENCE AS CORRELATES OF STUDENTS' ACHIEVEMENT IN CHEMISTRY

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Abstract
The study focused on motivation and academic resilience as correlates of students' achievement in chemistry. Three research questions guided the study and three hypotheses were tested at 0.05 level of significance. Correlational survey design was adopted for the study. The population of the study was 24, 372 senior secondary school year two (SS2) chemistry students in Anambra state. A sample of 1,200 students was involved in the study. The instruments for data collection were Academic Motivation Scale (AMS) and Students' Academic Resilience Scale (SARS) validated by two experts in Departments of Science Education and Educational Foundations, from Nnamdi Azikiwe University, Awka. The reliability of the instruments were established using Cronbach Alpha which yielded coefficient values of 0.69 and 0.72 for AMS and SARS respectively. Data were generated for the

study through the administration of the instruments with the aid of research assistants. The data obtained were analysed using linear regressions. The findings of the study revealed that achievement scores in chemistry are significantly related to motivation as well as academic resilience. Achievement in chemistry was also significant co-predicted by motivation and academic resilience. The study recommended that chemistry teacher should observe their students to identify those with very poor motivation and academic resilience and recommend them for counselling. Diagnostic analysis of students' motivation and academic resilience should be carried out at the point of enrolling to offer chemistry in order to help the students in the areas of weaknesses and boost their areas of strength.

Keywords: Motivation, resilience, achievement, chemistry.

Introduction

The academic achievement of students is affected by different factors which can be environmental, parental, psychological and social. The spate of poor achievement among science students has led to studies going beyond pedagogical strategies to find out how such factors as psychological factors may influence academic achievement. One of such variables that have gained attention of researchers is the students' motivation to study.

Motivation according Emily (2011) refers to reasons that underlie behaviour that is characterized by willingness and volition. It is the process that initiates, guides, and maintains goal-oriented behaviours. Motivation whether intrinsic or extrinsic has a dynamic link between students' learning and achievement (Dawson –brew &Nyarko-Sampson, 2017). Dawson-Brew and Nyarko-Sampson also asserted that students' psychological needs such as motivation and their school-related well-being are two points that may influence students' achievement. Intrinsically motivated students pursue academic excellence for reasons of the inherent satisfaction due to good academic achievement (Eccles&Wigfield, 2002). Other research findings have shown that individual students' characteristics variables such as motivational

orientation, self-esteem and learning approaches are important factors influencing academic achievements. . Of all the personal and psychological variables that have attracted researchers in this area of educational achievement, motivation seems to be gaining more popularity and leading other variables (Chelliah&Arulmoly, 2017). However, when students lack motivation the desire to study science subjects such as chemistry may wane. The difference is clear for students who have high motivation. Izuchi and Onyekuru(2017) found that there were significant correlations between academic self-concept, motivation and academic achievement of students. In the face of adversities and academic challenges, students need to have high motivation in other to continue their academic pursuit. Where such motivation is lacking, resilience is needed for students to succeed.

The concept of resilience has been viewed with discrepancies. However, most definition revolves around two core concepts: adversity and positive adaptation. Resilience according to Rutter (2006) is therefore, the relatively good psychological outcomes, despite exposure to acute or chronic stressors that are associated with negative outcomes. Academic resilience thus, is related to resilience in the academic context. It is the heightened likelihood of success in school and other life accomplishments despite environmental adversities brought about by early traits, conditions and experience (Tudor & Spray, 2018). Academic resilience means students achieving good educational outcomes despite adversity. The role of academic resilience in good educational outcome is enormous and involves strategic planning and detailed practice involving the whole school community to help vulnerable young people do better than their circumstances might have predicted (Schofield & Bates, 2016). Schools can help not only to beat the odds for individual students, but also with changing the odds for disadvantaged pupils across board.

In the spate of students' poor achievement in chemistry as noted in Chief Examiner's Reports over the years and the state of educational system in recent time especially the Corona virus pandemic clearly spells out the

importance of resilience among students.Mwangi, Okatcha, Kinai and Ireri (2015) posited that resilience can significantly affect school and life outcomes for students, including academic achievement. Resilient students sustain high levels of achievement and performance despite the presence of stressful events and conditions. Resilience, a multi-dimensional construct, is one of the most essential personal factors influencing academic achievement and it is the ability to pass the hardest problems, tolerate and overcome the most disastrous events, complex situations and pitfalls (Oke, Ayodeie, Aladenusi&Oyinloye, 2016).The ability to successfully deal with school-based setbacks is likely to be influenced by multiple interconnecting factors (Ungar&Leibenberg, 2011) including the motivation to continue learning after the pandemic. The fundamental question that requires empirical investigation therefore is: Do motivation and academic resilience individually and together correlate or predict achievement in chemistry. The need to pursue an investigation in this direction is because chemistry as a science subject poses challenges to the learners. There is also the problem of lack of adequate and well equipped laboratories and alarming students' population. Consumable chemicals are also expensive and require teachers to improvise. These conditions together with individual adversities facing the students requires that the need to have high level of motivation and academic resilience if they must attain good achievement.

Research Questions

The following research questions guided the study.

1. To what extent does motivation relate to students' achievement scores in chemistry?
2. To what extent does academic resilience relate to students' achievement scores in chemistry?
3. To what extent do motivation and academic resilience co-predicted students' academic achievement scores in chemistry?

Hypotheses

The following hypotheses were tested at 0.05 level of significance:

1. Achievement score in chemistry is not significantly related to students' motivation.
2. Achievement score in chemistry is not significantly related to students' academic resilience.
3. Achievement score in chemistry is not significantly co-predicted by students' motivation and academic resilience.

Method

The design of the study adopted for the study is correlational survey. This is because correlational studies seek to establish what relationship exists between two or more variables of interest to the researcher (Nworgu, 2015). All predictive studies according to Nworgu are correlation studies. The area of the study is Anambra state. Anambra state has six education zones namely: Aguata, Awka, Ihiala, Nnewi, Ogidi and Onitsha with a 256 secondary schools.

The population of the study was 24,372 senior secondary school year two (SS2) chemistry students. Total sample size for the study was 1,200 SS2 chemistry students. The sample for the study was drawn using multi-stage procedure. First, four education zones were selected at random out of the six education zones. Secondly, using purposive sampling, 10 schools were selected from each of the four education zones. The reason for their selection is because they have at least 25 SS2 chemistry students. Finally, in each of 40 schools, 30 SS2 chemistry students were selected accidentally sampled for the study.

The instruments for data collection are Academic Motivation Scale (AMS) and Students' Academic Resilience Scale (SARS). Academic Motivation Scale (AMS) was adapted from Njiru (2003) who developed a scale for measuring academic motivation using the Rasch Model. The original instrument measure three main aspects namely: striving for excellence, desire to learn and personal incentives. Striving for excellence has six sub-aspects: standards, goal, tasks, effort, values and ability. Desire to learn has sub-aspects: interest, learning from others, responsibility for learning. Personal incentive has three sub-aspects: extrinsic rewards, intrinsic reward, and social rewards. The modification to the original

instrument was the removal of the aspects and sub-aspect while retaining the items since the study is not interested in the various dimensions of motivation measurement. Also, the response option was developed by the researcher which deviated from the original instrument that required the students to rate themselves on 'what they aim for' and 'what they actually do' using a scale of one to four. The researcher instead used a four point scale of Very Much Likely (VML), Much Likely (ML), Likely (L) and Unlikely (UL).

Students' Academic Resilience Scale (SARS) is 30 items scale on which the students are to rate the academic resilience on a five point scale. The scale ranges from 5 (likely) to 1 (unlikely). The instrument is composed of negative and positively worded items that describe students' academic resilience on which the students are to rate their degree of resilience based on the statement. The instruments were validated by to two experts from the Department of Science Education and the Department of Educational Foundations respectively, with one experienced chemistry secondary school teacher. The reliability of instruments was established using Cronbach's Alpha. The instruments were administered to 40 students in Awka Education Zone which was not involved in the study. The scores generated were subject to Cronbach's Alpha computation which yielded reliability coefficients of 0.69 and 0.72 for AMS and SARS respectively.

The instrument was administered to the students through the help of five research assistants. The research assistants were briefed on the purpose of the study, the instruments and how to administer them as well as how to collate the students' academic achievement as contained in the chemistry teacher's inventory. Because the students were selected accidentally, the students were required to write their number in the attendance register on the instruments. The research assistants upon the return of the instruments examined them to ensure that the students responded to all the items in all the instruments and checked with the teacher to get the students' score in chemistry in three previous terms. All the instruments were returned to the research assistants the same day.

Data generated from the study were analysed using linear regressions. The correlation coefficients were interpreted using three-way guide for interpreting correlation coefficient values when a large number of pairs of scores have been correlated (Nworgu, 2015). They are: $r = \pm.30$ *and below*, low relationship; $r = \pm.30$ *to below* $\pm$ 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 where P-value is less than 0.05 (P<0.05), do not reject null hypothesis where P-value is greater than 0.05 (P>0.05).

Results

Research Question 1: To what extent does motivation relate to students' achievement scores in chemistry?

Table 1: Extent of Relationship between Motivation and Students' Achievement in Chemistry

Model	R	R^2	Adjusted R^2	Std. Error	Decision
1	.083[a]	.007	.006	14.42874	Low positive relationship

a. Predictors: (Constant), Motivation

Table 1 shows a low positive relationship (R = 0.083) between students' motivation and their achievement in chemistry. The R-Square value of 0.007 indicates that 0.7% of the variance in chemistry scores is predicted by students' motivation.

Research Question 2: To what extent does academic resilience relate to students' achievement scores in chemistry?

Table 2: Extent of Relationship between Academic Resilience and Students' Achievement in Chemistry

Model	R	R^2	Adjusted R^2	Std. Error	Decision
1	.086[a]	.007	.007	14.42474	Low positive relationship

a. Predictors: (Constant), Academic Resilience

Table 2 shows a low positive relationship (R = 0.086) between students' academic resilience and their achievement in chemistry. The R-Square value of 0.07 indicates that 0.7% of the variance in chemistry scores is predicted by academic resilience.

Research Question 3: To what extent do motivation and academic resilience co-predict students' academic achievement scores in chemistry?

Table 3: Extent of Correlation among Motivation, Academic Resilience and Achievement in Chemistry

Model	R	R^2	Adjusted R^2	Std. Error	Decision
1	.118[a]	.014	.012	14.38362	Low positive relationship

a. Predictors: (Constant), Motivation and Academic Resilience

Table 3 shows a low positive relationship (R = 0.118) among motivation, academic resilience and their achievement in chemistry. The R-Square value of 0.014indicates that 1.4% of the variance in chemistry achievement score is predicted by motivation and academic resilience.

Hypothesis 1: Achievement score in chemistry is not significantly related to students' motivation.

Table 4: Regression ANOVA on Significance of Relationship between Students' Motivation and Achievement in Chemistry

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1715.623	1	1715.623	8.241	.004[b]
	Residual	249409.709	1198	208.188		
	Total	251125.333	1199			

a. Dependent Variable: Achievement
b. Predictors: (Constant), Motivation

Table 4 shows that at 1df numerator and 1199df denominator, the F-value is 8.241 with a Pvalue of .004 which is less than 0.05. The null hypothesis was rejected.

Therefore, achievement score in chemistry is significantly related to students' motivation.

Hypothesis 2: Achievement score in chemistry is not significantly related to students'' academic resilience.

Table 5: Regression ANOVA on Significance of Relationship between Students' Academic Resilience and Achievement in Chemistry

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1853.799	1	1853.799	8.909	.003[b]
	Residual	249271.533	1198	208.073		
	Total	251125.333	1199			

a. Dependent Variable: Achievement
b. Predictors: (Constant), Academic Resilience

Table 5 shows that at 1df numerator and 1199 df denominator, the F-value is 8.909 with a P-value of .003 which is less than 0.05. The null hypothesis was rejected. Therefore, achievement score in chemistry is significantly related to students'' academic resilience.

Hypothesis 3: Achievement score in chemistry is not significantly co-predicted by students' motivation and academic resilience.

Table 6: Regression ANOVA on Significance of Students' Motivation and Academic Resilience Co-Prediction of Achievement in Chemistry

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	3479.755	2	1739.878	8.410	.000[b]
	Residual	247645.577	1197	206.889		
	Total	251125.333	1199			

a. Dependent Variable: Achievement
b. Predictors: (Constant), Academic Resilience, Motivation

Table 6: Shows that at 2df numerator and 1199df denominator, the F-value is 8.410 with a P-value of .000 which is less than 0.05. The null hypothesis was rejected. Therefore, achievement scores in chemistry are significantly co-predicted by students' motivation and academic resilience.

Since there was a significant joint prediction of achievement in chemistry by the predictor variables, the regression values for predicting the criterion variable is presented in Table 7

Table 7: Regression Coefficient on Students' Co-prediction of Achievement in Chemistry by Motivation and Academic Resilience

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	97.739	6.629		14.745	.000
	Motivation	-.133	.047	-.080	-2.803	.005
	Academic Resilience	-.088	.030	-.084	-2.920	.004

a. Dependent Variable: Achievement

The regression equation for the prediction of achievement score in chemistry therefore is:

Achievement in Chemistry = 97.739 + -0.133(Motivation) + -0.088(Academic Resilience)

Discussion

The observed significant relationship between motivation and achievement in chemistry could be attributed to the fact that motivation leads the students to study for their genuine interest in that specific field for its own sake. Highly motivated students are energetic, self-directed, competing and find themselves constrained to learn. High level motivation therefore, can give the students the idea that they can thrive in an academic test and with such ideas, they seek help where they do not have

the ability or could not understand a concept, just so that they can be successful.

The finding of the study supports that ofIzuchi and Onyekuru (2017) that academic self-concept, academic motivation and academic achievement correlated positively and significantly with one another. The finding of Chelliah and Arulmoly (2017) supports the finding of this study when they reported that motivation is significantly impacted academic achievement in mathematics. The finding of the study is however at contrast with the finding of Dawson-Brew and Nyarko-Sampson (2017) *that there was no correlation between intrinsic motivation and academic performance of students.*

The observed significant relationship between academic resilience and achievement in chemistry is because resilient students strive to meet academic demands despite underlying challenges. Students with high academic resilience adapt to behaviour that can help them succeed in the face of academic struggles. It can be said that the mind of academically resilient students is always positive. They accept challenges and see it as a step stone to grow. The students having overcome a particular academic challenge use that as a motivation to overcome future challenges. This is why the study findings revealed that motivation and academic resilience significantly predict achievement in chemistry.

The findings of the study is in line with the findings ofOke, et al (2016) which revealed that across all the groups studied, academic resilience was significantly correlated with academic achievement. The finding of the study also support the findings of Mwangi, Munithilreri, Mwaniki, and Wambugu (2015) that academic resilience is significantly correlated with academic achievement of girl boarders, boy day students, mixed day students and boy boarding students**.**

Conclusion

The study concluded based on the findings that motivation and academic resilience bear significant influence on students' achievement in chemistry. High motivation and academic resilience is needed to attain high achievement scores in chemistry.

Recommendations

The following recommendations are made in the light of the above findings:

1. Chemistry teacher should observe their students to identify those with very poor motivation and academic resilience and recommend them for counselling.
2. Diagnostic analysis of students' motivation and academic resilience should be carried out at the point of enrolling to offer chemistry in order to help the students in the areas of weaknesses and boost their areas of strength.
3. Serious attention should be given to students passing through hard times like illness, death of relatives, emotional instability among other, to ensure that they do not lose the motivation to learn chemistry or the resilience required to continue.

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