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FORMATIVE ASSESSMENT PRACTICES AS CORRELATE OF SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN CHEMISTRY

K. C. NWANI[1]; A. O. UKEJE[2]; C. K. UGAH[3]; G. C. ASANGA[4]; JOSHUA ADAMU[5]; & E.P. OKEKE[6]

[1,5]DEPARTMENT OF SCIENCE EDUCATION, FACULTY OF EDUCATION, FEDERAL UNIVERSITY OF KASHERE, GOMBE STATE, NIGERIA

[2,3,4,6] DEPARTMENT OF SCIENCE EDUCATION, FACULTY OF EDUCATION, UNIVERSITY OF NIGERIA, NSUKKA

Abstract

The study determined the relationship between formative assessment practices and students' academic achievement in chemistry. The design of the study was correlational research design. Multistage sampling procedure was used to draw 308 students from a population of 2,567 SS2 students in Awka Education zone of Anambra State. The 308 students were obtained from the 61 registered secondary schools in Awka education zone. Teachers Formative Assessment Practices Questionnaire (TFAPQ) and Chemistry Achievement Test (CAT) were used as instruments for data collection. The instruments were validated by three experts in Measurement and Evaluation from the Department of Science Education, University of Nigeria, Nsukka. A reliability coefficient of 0.89 was obtained using Cronbach Alpha reliability estimate. The data were collected using on the spot technique. The first research question was answered using linear regression analysis while research questions 2 and 3 were answered using multiple regression. All the hypotheses were tested using the t value for interaction obtained from Hayes Process Macro, all at 0.05 level of significance. The result shows that there was a high and positive relationship between formative assessment practices and chemistry students' academic achievement and the relationship between formative assessment practices and chemistry students' academic achievement is significant. Workshops and seminars were recommended for secondary school teachers on the effectiveness of teachers' assessment practices and how it relates to the students' overall academic achievement. The study also recommended that various formative assessment practices should be incorporated in teaching and learning processes to enable teachers harness the power of formative assessment to improve students' academic achievement.

Key words: Assessment, Formative Assessment Practices, Academic Achievement, Chemistry

Introduction

Assessment is the bedrock that provides additional and useful information on the progress and shortfalls of teaching and learning processes. It is a powerful instrument employed by teachers to improve teaching and learning in any educational system (Koh, 2011). Assessment is the process of gathering and evaluating information to get an outcome used

to inform teaching and learning process. Keziah and Nwani (2020) maintained that assessment involves the collection of data from various sources with the aim of obtaining information that would be used to evaluate students, effectiveness of the learning process, quality of instructional material as well as make decisions based on the information obtained. Assessment takes various forms; Assessment for learning, Assessment As learning and Assessment of learning.

Assessment for learning is also known as Formative Assessment, while Assessment As learning is also known as learner's evaluation; that is self-evaluation and Assessment of learning is known as Summative Assessment. Summative Assessment is an assessment that is carried out at the end of a course or lesson or session, or semester to measure the abilities of the students. It's a promotional assessment that functions with grading. Assessment as learning is an assessment done by the learners, to know the level of their achievement with respect to the objectives or goals of the lesson. Assessment for learning, that is formative assessment is the evaluation that occurs during the lesson, it is an ongoing assessment. Its aim is to improve the teaching strategy, elicit students' weakness and strength, and to provide specific and immediate feedback.

Formative Assessment is a type of assessment that takes place during the course of teaching and learning. Its main aim is to give direction to and strengthen the instructional process. In formative assessment, teachers employ a number of strategies and techniques to ensure that formative assessment is carried out simultaneously with teaching in the classroom. These strategies and techniques are referred to as formative assessment practices (Keziah & Nwani, 2020). Formative assessment practices according to Tony (2017) are techniques designed by a teacher to inform instruction by giving specific and immediate feedback through the daily, ongoing instructional strategies that are student-centred, as well as classroom-centred. Agwagah and Ezieke (2023) maintained that formative assessment practice is an instructional procedure that engages intentional and strategic approach during classroom instruction in order to enhance teaching and learning. Formative Assessment practices are strategies used in the course of teaching that facilitate and help to elicit students' state of understanding and also to direct the instructional process, in order to making learning and teaching effective.

Formative Assessment practices are characterized by clarifying learning objectives, classroom discussions, teacher's feedback, self and peer assessment. Magno and Lizada (2015) identified thecharacteristics of formative assessment practices to be instruction-based, an ongoing evaluation, involves self and peer assessment, helps students focus on learning goals, involves collaboration between teacher and students to achieve the stated learning objectives, develops basic skills to integrated skills, and uses multiple forms of assessment. Deductively, formative assessment practices are all student-centred learning strategies that help to improve students' learning outcome by helping them move from their present state of knowledge to the next level by following the learning objectives. The techniques and tools that strengthen formative assessment practices can be in form of quizzes, think-pair-share, strategic questioning, one minute paper, admit and exist tickets, analysis of students' work (Northwest Evaluation Association- NWEA, 2016; Agwagah & Ezieke, 2023). These techniques and tools that strengthen formative assessment practices

could also enhance students' academic achievement.

Academic achievement is the level of knowledge, skills acquired and attitude cultivated after a series of teaching and training within duration of time. It is a self-perception and self-evaluation of one's success, having gone through a test or examination (Achufusi, 2019). Examination of student's level of knowledge and skills is conducted through both formative and summative assessment. Irrespective of the procedural use of both formative and summative assessment in schools, it seems as if the academic achievement of students in chemistry is consistently on the downward trend. This is in line with the WAEC Chief Examiner's report for 2019 and 2020 that due to the identified students' weaknesses, they should improve on their mathematical skills, be familiar with ions and their symbols, learn how to write IUPAC names of compounds, learn how to write inference from observations, improve on their study habit, should be exposed early to practical. There have been studies that showed that formative assessment improves the final academic achievement of students, while some studies found that summative assessment is the major assessment that improves students' academic achievement. Such a study by Kamara and Dadhabai (2022) reported that summative assessment has more influence over students' academic achievement than formative assessment. The study by Ashdale (2020) revealed that formative assessment strategies have no influence on students' academic achievement.

Another study by Olagunju (2015); Ozan and Kıncal (2018); Matilda and Helen (2019); Dandekar (2020); Ferdinal and Isramirawati (2020); and Agwagah and Ezieke (2023) revealed that formative assessment greatly improved students' academic achievement. Due to the controversy of findings from studies conducted, this present study tends to further investigate formative assessment practices as correlates of students' academic achievement in chemistry. This study assessed the relationship between formative assessment practices and students' academic achievement in chemistry.

Specifically, the study sought to determine the:

1. relationship between formative assessment practices and chemistry students' academic achievement
2. influence of gender on the relationship between formative assessment practices and chemistry students' academic achievement
3. Influence of school location on the relationship between formative assessment practices and chemistry students' academic achievement

Research Questions

The following research questions guided the study:

1. What is the relationship between formative assessment practices and chemistry students' academic achievement?
2. What is influence of gender on the relationship between formative assessment practices and chemistry students' academic achievement as moderated by gender?
3. What is influence of school location on the relationship between formative assessment practices and chemistry students' academic achievement?

Hypotheses

The following hypotheses guided the study as were tested at 0.05 level of significance:

1. There is no significant relationship between formative assessment practices and chemistry students' academic achievement.
2. There is no significant influence of gender on the relationship between formative assessment practices and students' academic achievement.
3. There is no significant influence of school location on the relationship between formative assessment practices and students' academic achievement.

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METHODOLOGY

The design of the study is a correlational research design. This design was adopted because according to Nworgu (2018) it is a design that seeks to establish relationship among variables in a study. This design was considered befitting for the study because the study tends to establish the relationship between formative assessment practices and students' academic achievement. The multistage sampling procedure was used to draw 308 students drawn from a population of 2,567 SS2 students in Awka Education zone of Anambra State. In the first stage, purposive sampling technique was used to select science schools that offer chemistry. In the second stage, stratified sampling was used to group the schools based on their local government. In the third stage, simple random sampling was used to select three local governments from al the local governments. In the fourth stage, simple random sampling technique was used to select three schools from the three local governments that emerged. In the fifth stage, purposive sampling was used to select the SS2 students in the schools that emerged making a total of 308 chemistry students for the study.

Teachers Formative Assessment Practices Questionnaire (TFAPQ) and Chemistry Achievement Test (CAT) were used as instrument for data collection. Each of the instruments was made up of 20 items. The instruments were validated by two experts in Measurement and Evaluation and one expert from Chemistry education all from the Department of Science Education, University of Nigeria, Nsukka. The validators were asked to check the clarity, simplicity and appropriateness of the items with respect to the research questions and hypotheses that guided the study. The data were collected immediately using on the spot technique. The first research question was answered using simple regression analysis while research questions 2 and 3 were answered using multiple regression. All the hypotheses were tested using the t value for interaction obtained from Hayes Process Macro, all at 0.05 level of significance.

RESULTS

Research Question One

What is the relationship between formative assessment practices and chemistry students' academic achievement?

Table 1: regression analysis on the relationship between formative assessment practices and chemistry students' academic achievement

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	T	Sig
1	.898[a]	.806	.805	6.71720	35.621	.000

The result in table 1 shows that the correlation coefficient (R) of .898 was obtained for the relationship between formative assessment practices and chemistry students' academic achievement. The result shows that there was a high and positive relationship between formative assessment practices and chemistry students' academic achievement. Coefficient of determination (R^2) of .806 was obtained, which means that 81% of the students' academic achievement is related to the teachers' formative assessment practices. The result also shows that a t-value of 35.621 with an associated probability value of .000 was obtained. The associated probability value of .000 is less than 0.05 level of significance set as benchmark for taking decision. This is an indication that there is a significant relationship between formative assessment practices and chemistry students' academic achievement.

Research Question Two

What is the influence of gender on the relationship between formative assessment practices and chemistry students' academic achievement?

Table 2: regression analysis on the influence of gender on the relationship between formative assessment practices and chemistry students' academic achievement

R	R Square	Std Error	T	p-value
.898	.807	.049	1.410	.160

The result in table 2 shows that the correlation coefficient (R) of .898 was obtained for the influence of students' gender on the relationship between formative assessment practices and chemistry students' academic achievement. The result shows that there was a high and positive relationship between formative assessment practices and chemistry students' academic achievement as moderated by gender. Coefficient of determination (R^2) of .807 was obtained, which means that 81% of the students' academic achievement is related to the teachers' formative assessment practices. The result also shows that a t-value of 1.049 with an associated probability value of .160 was obtained. The associated probability value of .160 is greater than 0.05 level of significance set as benchmark for taking decision. This is an indication that there is no significant relationship between formative assessment practices and chemistry students' academic achievement as moderated by students' gender.

Research Question Three

what is the influence of school location on the relationship between formative assessment practices and students' academic achievement?

Table 3: regression analysis on the influence of school location on the relationship between formative assessment practices and chemistry students' academic achievement

R	R Square	Std Error	T	p-value
.899	.807	.049	-1.349	.178

The result in table 3 shows that the correlation coefficient (R) of .899 was obtained for the influence of school location on the relationship between formative assessment practices and chemistry students' academic achievement. The result shows that there was a high and positive relationship between formative assessment practices and chemistry students' academic achievement as moderated by location. The coefficient of determination (R^2) of .807 was obtained, which means that 81% of the students' academic achievement is related to the teachers' formative assessment practices. The result also shows that a t-value of -1.349 with an associated probability value of .178 was obtained. The associated probability value of .178 is greater than 0.05 level of significance set as benchmark for taking decision. This is an indication that there is no significant relationship between formative assessment practices and chemistry students' academic achievement as moderated by school location.

Discussion of the Findings

Based on the findings of the study, it was revealed that there is a high and positive relationship between formative assessment practices and chemistry students' academic achievement and there is a significant relationship between formative assessment practices and chemistry students' academic achievement. The findings also revealed that there is a high and positive influence of students' gender on the relationship between formative assessment practices and chemistry students' academic achievement. The hypothesis also shows that there is no significant influence of gender on the relationship between formative assessment practices and chemistry students' academic achievement. The findings also revealed that there is a high and positive influence of school location on the relationship between formative assessment practices and chemistry students' academic achievement. The hypothesis also revealed that there is no significant influence of school location on the relationship between formative assessment practices and chemistry students' academic achievement.

From the result of the study, it is indicative that the assessment practices by secondary school chemistry teachers have direct, positive and high relationship with teachers' assessment practices. This means that the way the teacher assesses the students also enhance or affect the students' academic achievement. The result of the findings was in disagreement with the report of Ashdale (2020) who reported that formative assessment strategies have no influence on students' academic achievement. The result of the finding was however in agreement with the findings of Olagunju (2015); Ozan and Kıncal (2018); Matilda and Helen (2019); Dandekar (2020); Ferdinal and Isramirawati (2020); and Agwagah and Ezieke (2023) who reported that formative assessment greatly improved students' academic achievement.

Conclusion and Recommendations

The study therefore concluded that there is a high and positive relationship between formative assessment practices and chemistry students' academic achievement. Based on the findings, the following recommendations were made:

1. Workshops and seminars should be organized for secondary school teachers on the effective use of formative assessment practices so as to enlightened them on how it relates to the students overall academic achievement.
2. Various formative assessment practices should be incorporated in teaching and learning processes to enable teachers harness the power of formative assessment to improve students' academic achievement

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