Effect of Diagnostic and Feedback Assessment Approaches in Enhancing Achievement in Mathematics among Secondary School Students in Calabar Municipality

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Abstract

The study is aimed at examining the effect of diagnostic and feedback assessment approaches in enhancing achievement in Mathematics among secondary school students in Calabar Municipality in Cross River State. Two Research questions were raised and two hypotheses stated. The design adopted was a pre-test and post-test quasi experimental research design. 3 secondary schools out of 17 public secondary schools in Calabar municipality were used for the study. In the school selected, two classes were used as experimental group and one class as control group, that is, two experimental groups and one control group were used. Two intact senior secondary classes were randomly selected for each of the two groups. A total number of 119 students were used as participants for the study. The instrument that was used was a Mathematics Achievement Test (MAT) designed by the researchers with the help of two classroom teachers in Mathematics. Items used were adopted from past question papers in WAEC and NECO according to the syllabus in SS2. The instrument containing 30 items was face and content validated and was pilot tested using Cronbach alpha to determine its reliability co-efficient which was found to be 0.84. The research was conducted by giving treatment to the experimental groups while the control group was not given any treatment. The data were collected and analyzed using Analysis of Covariance (ANCOVA) with the pretest as a covariate controlling for pre-existing difference among them. The result shows that diagnostic and feedback assessment approaches enhance academic performance in Mathematics. Recommendations were proffered.

Keywords: Formative Assessment, Approaches, Diagnostic, Feedback, Academic Performance, Calabar, Nigeria.

Reference to this paper should be made as follows:

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INTRODUCTION

Education is an intentional or purposive adventure. It is a planned activity in the school setting with outlined objectives, goals and aims to instill in the individual functional ability to contribute to the development of the society. The heart of every educational programme, plan and activity is to ensure that the individual is well equipped with the right and worthwhile knowledge that will advance the socio-economic, technological and cultural development of the society. This is the reason why curriculum activities, selection of objectives, learning experiences, instructional methods and strategies are centred on satisfying the needs and interests of the learner who inversely satisfies the needs of the society. The question that arises therefore, is, how can it be ascertained that these objectives and experiences selected for the learner are achieved? What mechanism can be used to ascertain the attainment of these objectives? Assessment procedures and approaches become inevitable.

Assessments in education have undergone a lot of caesarian operation. This is largely due to the microscopic lens of experts to what assessment embodies. Ukwuije and Opara (2013) viewed assessment as a systematic process of determining the extent to which instructional objectives are met by students. This implies that assessment is not an activity that is meant to be carried out haphazardly. It is a conscious activity with a detailed and predetermined specification of how it can be carried out in order to improve instructional delivery. Assessment to Onuka and Olupide (2004) is the process of collecting data or information in order to estimate the quality of a programme or instructional activity. Whenever the term assessment is mentioned in the classroom situation, it is concerned with obtaining relevant information either through test, interviews, observations, etc, in order to specify and verify problems associated with the teaching strategies, learner's attainment of stated instructional objectives among others.

Assessment in classroom situation takes different approaches. It could be diagnostic, peer assessment, feedback assessment, self-assessment, teacher-guided assessment among others. Each of these approaches tries to measure teaching and learning effectiveness (Joshua and Ikiroma, 2013). Diagnostic assessment is a form of formative assessment technique that is used mostly in the cognitive domain to ascertain students' level of understanding, cognitive ability to a particular content area. It is a technique that is used before actual teaching and learning processes begin. Diagnostic assessment can be likened to a diagnosis carried out on a patient in order to make the right prescription. Any good doctor that must hit the sickness at once must first diagnose the problem. The teacher in the classroom must do same if learners must be helped to improve in their academics. Okeke in Casmir (2014) summarized some of the importance of using formative and diagnostic tests in the inculcation of scientific thought in the evaluation of Biology practical as: the formative and diagnostic tests provide opportunity to promote the scientific method of thought. Diagnostic tests extend and re-reinforce theoretical learning. He also mentioned that they promote problem solving and self-reliance in real life situation. Getting involved in formative and diagnostic tests can also enable students to learn much about the interrelationship between biology and other science subjects (p 38-39).
Diagnostic evaluation is used to identify underlying causes of those problems that do not respond to first aid treatment. In developing a diagnostic test in a subject, several component abilities necessary for successful performance in the area must be covered. Thus, a diagnostic test usually contains many sub-tests, each aims at measuring a particular component part. Items of the test should also be constructed in such a way that students are given the opportunity of committing errors that will indicate their deficiencies. Thus, the primary concern of diagnostic evaluation is not to find out how much the student scores but his or her area of difficulty. According to Dryn (2007), diagnostic tests are most relevant in subjects

where acquisition or some skill or knowledge is a condition for the learning of higher concepts.

Feedback is vital to formative assessment, but not all feedback is effective. Feedback will inform students how well they are progressing. Feedback needs to be timely and specific, and should include suggestions for ways to improve future performance. Good feedback should be tied to explicit criteria regarding expectations for students' performance, thus making the learning process more transparent, and modelling "learning to learn" skills for students (CERI, 2008).

Udoukpong and Okon (2012) carried out a study on the extent to which students' academic performance in Junior Secondary Certificate Examination (JSCE) in social studies is differentiated by their perception of teachers' formative evaluation practices. A sample of 300 Junior Secondary Three (JS-3) students was surveyed. The subjects responded to a questionnaire on teachers' formative evaluation practices while their academic performance was determined by their scores in social studies in JSCE. Students' academic performance in social studies differed significantly on the basis of their perception of teachers' formative evaluation practices. Wiggius in Irorite raye-Adjekporu (2013) noted that without provision of result of students' assessment (feedback) about their extent of achievement, no student can improve. The result of assessment approaches have been found to be effective in improving instruction. According to Akubuiro, Ofem and Ovat (2015), assessment in the classroom helps the teacher to understand the effectiveness of a choice instructional strategy and facilities, provide remediation to students' inabilities, guides and motivates students to be fully engaged in their own learning. This implies that assessment is aimed at enhancing instruction and learners' performance.

Over the years, it is observed with dismay the alarming failure of students in mathematics. Mathematics as a subject that is a prerequisite for students' admission, a subject that is offered to ensure that learners acquire the right scientific skills that can help the nation drive speedily to its technological development stage, has suffered not seeing students do well in it. One continues to wander on what possible could be responsible for this failure. Many researchers have suggested a lot of factors ranging from the cognitive to affective and even intuitional. The researchers are presuming that the pattern or approaches to instruction utilized by classroom teachers could be responsible for this failure and it is on this backdrop that this research effort is carried out to examine the effect of diagnostic and feedback assessment approaches in enhancing mathematics achievement among secondary school students.

Research Questions

The following questions were raised to guide the study:

- What is the difference in mathematics achievement of students taught after diagnostic assessment and those without the treatment?
- What is the difference in mathematics achievement of students with feedback assessment and those without the treatment?

Hypotheses

The following hypotheses were stated in order to find answers to the problem of the study:

- There is no significant difference in mathematics achievement of students exposed to diagnostic technique and those without the treatment.

- There is no significant difference in mathematics achievement of students exposed to feedback technique and those without the treatment

METHODOLOGY

The design adopted was a pre-test and post-test quasi experimental research design. 3 secondary schools out of 17 public secondary schools in Calabar municipality were used for the study. In the school selected, two classes were used as experimental groups and one class control group. That is, two experimental groups and one control group were used. Two intact senior secondary classes were randomly selected for each of the two groups. The total number of students used for the study is shown below.

Table 1: Distribution of sampled students, schools and groups

School	Class	Groups	Sample (N)
A	SS1 C	Experimental	39
B	SS1 B	Control	35
C	SS1 A	Experimental	45
Total			**119**

The instrument that was used was a Mathematics Achievement Test (MAT) designed by the researchers with the help of two classroom teachers in Mathematics. Items used were adopted from past question papers in WAEC and NECO according to the syllabus in SS2. The instrument containing 30 items was face and content validated and was pilot tested using Cronbach alpha to determine its reliability co-efficient which was found to be 0.84. The research was conducted by giving treatment to the experimental groups while the control group was not given any treatment. The mathematics teachers in each school and in senior classes were used and the area of coverage was given to them to teach on. Both groups were taught the same content but they were given instructions on how to go about it in the treatment groups. SS1 C in group A and SS1 A in group C were taught with the diagnostic and feedback assessment techniques. For SS1 C, at the beginning of the lesson, the teacher asked certain questions to the students in order to collect responses on the level of cognitive attainment while for students in SS1A in group C, the teacher gave a classwork, marked students' scripts and gave them the result. The exercise lasted for eight weeks. A pre-test was already given to the groups (SS1 C, SS1 B, and SS1 A) before the investigation. At the end of the eight weeks, a post test was finally obtained for the three groups to find out whether the treatment had any effect on students' mathematics achievement. The data was collected and analyzed using Analysis of Covariance (ANCOVA) with the pretest as a covariate controlling pre-existing difference among them.

RESULTS

Research Question One and Hypothesis One

There is no significant effect of diagnostic evaluation on students' academic performance in Mathematics

The result in Table 2 shows that the post-test mean of the experimental group of *24.08* is greater than the post-test mean of control group of *14.46*. This implies that those in the experimental group performed better after they were exposed to the treatment than their counter part (control group) who were not exposed to the treatment. When these means were

compared, using analysis of covariance (ANCOVA) with the pretest as a covariate, the result showed that $F = 145.718; P > .05$. This implies that the null hypothesis which states that there is no significant effect of diagnostic evaluation on students' academic performance in Mathematics is rejected.

Table 2: Summary of means, standard deviation and analysis of covariance (ANCOVA) result on effect of diagnostic evaluation on students' academic performance in Mathematics

Variable	N	X	SD		
Diagnostic group	39	24.08	1.88		
Control group	35	14.46	4.52		
Source	**Type III sum f Squares**	**df**	**MS**	**F**	**Sig.**
Corrected model	1708.44	2	854.22	73.07	.000
Intercept	1043.34	1	1043.34	89.42	.000
Pretest	1.452	1	1.452	.124	.076
Group	1703.47	1	1703.47	145.718	.000
Error	830.003	71	11.69		
Total	30755.00	74			
Corrected total	2538.73				

Research Question Two and Hypothesis Two

There is no significant effect of feedback evaluation on students' academic performance in Mathematics.

The result in Table 3 shows that the post-test mean of the experimental group of 16.54 is greater than the post-test mean of control group of 14.46. This implies that those in the experimental group performed better after they were exposed to the treatment than their counter part (control group) who were not exposed to the treatment. When these means were compared, using analysis of covariance (ANCOVA) with the pre-test as a covariate, the result showed that $F = 30.642; P < .05$. This implies that the null hypothesis which states that there is no significant effect of feedback evaluation on students' academic performance in Mathematics is rejected.

Table 3: Summary of means, standard deviation and analysis of covariance (ANCOVA) result on effect of feedback evaluation on students' academic performance in Mathematics

Variable	N	X	SD		
Feedback group	45	16.54	1.88		
Control group	35	14.46	4.22		
Source	**Type III sum f Squares**	**df**	**MS**	**F**	**Sig.**
Corrected model	967.47	2	483.73	17.91	.000
Intercept	648.076	1	1648.07	23.998	.000
Pretest	2.456	1	12.45	.091	.091
Group	827.516	1	827.51	30.642	.30.642
Error	1917.408	71	27.026		
Total	32365.00	74			
Corrected total	2884.878	73			

DISCUSSION OF RESULTS

The result of hypothesis one shows that students who were exposed to diagnostic evaluation before teaching performed better than those who were not exposed to it. This could probably be due to the fact that diagnostic evaluation will help the teacher or instructor to ascertain first the knowledge base level of the learner as well as gather fact about their previous knowledge on that particular area in order to know where the lesson will actually begin. This is to say that it will help the teacher to build on existing knowledge level of the learner. The result was in line with the findings of Dryn (2007) who posited that diagnostic evaluation is to help the teacher build on existing skills and knowledge of the learner.

The result also shows that students who were provided with feedback of their performance performed better than those who were not. The findings were in line with that of Wiggius in Irorite raye-Adjekporu (2013), who noted that without provision of result of students' assessment (feedback) about their extent of achievement, no student can improve. The result of assessment approaches have been found to be effective in improving instruction. That feedback will inform students how well they are progressing in their academics and may induce learners into putting more effort in their studies.

CONCLUSION AND RECOMMENDATIONS

From the findings of the study, it was concluded that diagnostic and feedback assessment approaches have significant effect on students' academic performance in Mathematics. Based on the conclusion of the study, it was recommended that teachers should be trained and retrained on how to utilize these approaches in educating the Nigerian child in order to boost their understanding of Mathematics. These assessment approaches should be utilized in daily classroom interactions. Teachers should utilize diagnostic and feedback approaches in their classroom activities to ensure that students' areas of weaknesses are discovered, strengths and weaknesses ascertained to aid in the utilization of appropriate teaching method to aid the learner.

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