Effect of Feedback on the Performance of Secondary School Students in Mathematics in Ekiti State.

Olofinlae, O.O

Department of Mathematics, College of Education, Ikere-Ekiti, Ekiti State, Nigeria.
E-mail: latjaylove1591@gmail.com

Abstract

The study focused on the effect of feedback on the performance of Senior Secondary School Students in mathematics in Ekiti State. It employed a quasi-experimental research design of pre-test and post-test type. The population of the study consisted of all Senior Secondary School Two (SSS2) students in Ado Local Government Area of Ekiti State. A sample of one hundred (100) SSS2 students was selected from four secondary schools using a multi-stage random sampling technique. The instrument for data collection consisted of self-structured Students Mathematics Performance Test (SMPT) whose reliability coefficient was obtained as 0.74 using Pearson Product Moment Correlation Coefficient (PPMC). Three research hypotheses were formulated and tested using t-test statistic at the α=0.05 level of significance. Findings revealed that there was no significant difference between the mean performance scores of students who were provided feedbacks and those without feedbacks in mathematics pre-test. However, a significant difference existed between the mean performance scores of students who were provided feedbacks and those without feedbacks in mathematics post-test, attributable to the treatment. It was recommended that feedback should be provided for students to aid their performance.

Keywords: Feedback, Information, Strategies, Performance, Mathematics

Introduction

Mathematics is a very important subject due to its application to human daily activities (Sunday, Akamu & Fajemidagba, 2014). It is the basis for national development since it can be applied to every aspect of human existence including the economic development of any country (Charles-Ogan,2015). Mathematics is the basic requirement for the study of science and technology, hence any nation that seeks development must not pay lip service to mathematics education. No wonder it is a compulsory subject for all secondary school students. Advanced English Dictionary (2020) defines feedback as "the process in which part of the output of a system is returned to its input to regulate its further output". According to Carless & Boud, (2018), it is a process through which learners make sense of information from various sources and use it to enhance their work or learning strategies. Feedback is not only about

students getting information from teachers about their strengths, weaknesses, and how to improve; such information could be obtained from peers, teachers, friends, family members, or automated computer-based systems toward supporting students' self-evaluation of their progress. Feedback refers to information provided by an agent such as teacher, peer, or administrator about some aspects of an individual's performance (Archer, 2010; Hattie & Timperley, 2007). A teacher can give feedback to students in many ways, it must, however, be noted that giving more tests is not the solution. According to Epstein (2007), the solution lies in how the tests are designed. Instruction must occur before the feedback (Hattie and Timperley, 2007) and task performance must be observed (Norcini, 2010) for the feedback to be effective. According to Hattie and Timperley (2007), effective feedback should provide answers to three questions: (1) where am I going, that is, what are the goals? (2) how am I going, that is, what progress is being made toward the goal? and (3) where to next, that is, what activities need to be undertaken to make better progress?

Feedback is important to student learning (Ferguson, 2011; Krause & Stark, 2010) since its main purpose is to help learners adjust their thinking and behaviours to produce improved learning outcomes (Shute, 2008). It is an important variable influencing learning most especially in the assessment of students since students may have limited absolutist beliefs about knowledge and prefer to receive unequivocal corrective feedback (O'Donovan 2017). Feedback enables teachers to know the extent of information the students have learned. Types of feedback according to Hattie & Timperley (2007) include cues, reinforcement, video or audio feedback, computer-assisted instructional feedback, and student evaluation feedback. Others include praise, reward, punishment, corrective feedback, and programmed instruction. While it is required of students to play a major role in sense-making and using the received comments to improve their work, teachers on their part must encourage students to make use of the feedback they receive. This is because students sometimes fail to recognize or appreciate forms of feedback other than written comments on submitted work (Price, Handley, and Millar 2011). Therefore, learners receiving feedback should get information regarding their performance, which may tell them how well they have done a task and how to improve. Interestingly, feedback identifies for the learner, the gap between their level of performance and their desired level (Shute,2008). Consequently, feedback should be goal-oriented, prioritized, actionable, and student-friendly. It must be on-going, consistent, and timely (The Graide Network,2020). Hattie & Timperley (2007) while suggesting possible ways through which students can reduce the gap between current and desired understandings in response to feedback, opined

that students can increase their effort, most especially when the effort leads to tackling more challenging tasks.

In Ekiti State, the performance of students in the West African Examinations Council (WAEC) in the last few years is far from encouraging. Ekiti State has consistently remained in the two digits position for over five years. The State was ranked 17th in 2015, 11th in 2016 (Nigerian Tribune, 2016), and had consistently occupied the 11th position in the 2017 and 2018 West African Senior Secondary Certificate Examination (WASSCE). However, the State ranked 12th in 2019 WASSCE, an indication that the performance of students in the state has been fluctuating, an issue of concern to the government of the State (Nigerian Tribune, 2019). At the national level, Students have not been performing to the required standard, a situation which made the examination body to urge candidates to visit the portal to study the Chief Examiners' reports as a source of feedback on candidates; previous performances (The Authority, 2020). The West African Examinations Council (WAEC) Chief Examiners' Reports May/June (2017 and 2018) advised teachers to give more worked problems to students during class lessons as well as make teaching and learning interactive.

Several attempts have been made to improve the performance of students in mathematics. Such attempts have been made to review the 3W-H factors namely whom to teach (learner), what to teach (concept/content/objective), where to teach (classroom), and how to teach (method/strategies). The contents and concepts must meet the needs of the targeted learner. In other words, the learner must be taught what he needs to learn in a suitable environment using the appropriate strategy.

Several researches have been conducted concerning different strategies and students' performance. Some have shown that significant difference existed between students' gender and performance. Jabor, Machtmes, Kungu, Buntat, and Nordin (2011) reported that female students performed better than their male counterparts, whereas Usman (2007) found out that male students performed better than their female counterparts. However, some obtained contradicting findings that no significant difference existed between the performances of male and female students (Jegede, 2007; Gambari & Yusuf, 2014. Researches have also found significant difference related to performance in favour of strategies (Jegede, 2007; Akinbobola, 2015). Feedback had been found to have a positive effect on students' performance rather than harm their self-esteem (Siewert, 2011). Findings by Kim & Lee (2019) showed that positive feedback had a significant influence on students' self-efficacy and positive emotions while negative feedback had a significant influence on negative emotions.

Purpose of the study

The study was carried out to find the effect of feedback on the performance of students in mathematics. It made a comparison between the performance of students whose marked scripts (assignment and test sheets) with teacher's comments were returned and those whose scripts (assignment and test sheets) were returned without the teacher's comment.

Research Questions

The following questions were raised for the study.

1. Is there any difference between the performance of students who received feedback and their counterparts who were without feedback in the mathematics pre-test?

2. Is there any difference between the performance of students who received feedback and their counterparts who were without feedback in mathematics post-test?

3. Is there any difference between the performance of male and female students who received feedback in mathematics post-test?

Research Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance.

1. There is no significant difference between the mean performance scores of students who received feedback and those without feedback in the mathematics pre-test.

2. There is no significant difference between the mean performance scores of students who received feedback and those without feedback in mathematics post-test.

3. There is no significant difference between the mean post-test scores of male and female students who received feedback in mathematics.

Methodology

The study was carried out using a quasi-experimental research design of pretest, posttest, and control group design in which there was one experimental group and one control group. The academic performance that was used for the study was established by a pre-test conducted on both experimental and control groups to ascertain the homogeneity of the sample. Post-test after the treatment was used to measure improvement in academic performance due to the treatment.

Population, Sample and Sampling Techniques

The population for this study comprised of all Senior Secondary School Two (SSS2) students in Ado Local Government Area of Ekiti State. A multi-stage random sampling technique was

used to select a sample of one hundred (100) students comprising of 50 students in each of the experimental group and control group from four (4) secondary schools for the study.

Instrument

A self-developed instrument (Student Mathematics Performance Test, SMPT) was used to study the effect of feedback on the performance of Senior Secondary School students in mathematics. SMPT consisted of two sections A and B. Section A required the student to give their bio-data information such as identification number, sex, age, school, and Local Government Area, while section B contained 20 multiple-choice questions, awarded 20 marks for 30 minutes.

Reliability of the Instrument

The reliability of the instrument was established through test-retest by administering the test on some students who were not part of the sample for the study. The data obtained from the test-retest was subjected to Pearson Product Moment Correlation analysis and a reliability coefficient of 0.74 was obtained which was high enough to adjudge that the instrument was reliable for the study

Administration of the Instrument

The process of administering the instrument was in three stages namely pre-treatment, treatment, and post-treatment stages respectively. The pre-treatment stage involved the researchers paying visits to the sampled schools where the supports of the teachers who would serve as research assistants and the cooperation of the students were sought. The students were then given identification numbers and assigned into experimental and control groups respectively based on their schools. Thereafter, the Students' Mathematics Performance Test (SMPT) was administered on the students. The treatment stage involved three weeks of teaching by the research assistants using the instructional guide to teach the students. On the fourth day of the first week, students in both groups were given an assignment which was submitted the following day. On the last day of the week, the marked scripts with the teacher's comments were returned to the experimental group while the marked scripts of those in the control group were returned without the teacher's comments. The same process was repeated in the second week except that the assignment was replaced with a test to evaluate their learning. At the post-treatment stage, the same SMPT was restructured and then administered on the students on the last day of the third week. The responses to the SMPT were collected, marked, and collated for data analysis.

Method of Data Analysis

Data was generated through pre-test and post-test scores obtained from the Students Mathematics Performance Test (SMPT). The student's *t*-test statistic of independent sample was used to test the three (3) hypotheses at 0.05 alpha levels.

Results

This section explains the descriptive analysis and the test of hypotheses using *t*-test statistic at p<0.05.

Hypothesis I: There is no significant difference between the mean performance scores of students who received feedback and those without feedback in mathematics pre-test.

Table 1: t-test analysis of difference between the mathematics pre-test scores of students who were provided with feedback and those without feedback.

Group	N	Mean	SD	Df	t_{cal}	t_{tab}	Decision
Experimental	50	12.00	3.31	98	0.23	1.98	NS
Control	50	11.85	3.11				

P<0.05 level of significance   NS=Not Significant

Table 1 revealed that the calculated value of t (0.23) was less than its critical value (1.98) at 0.05 level of significance. Consequently, no significant difference existed between the mean performance scores of students who received feedback and those without feedback in mathematics pre-test. The null hypothesis was therefore upheld. Hence, there was no difference in the previous knowledge of respondents in experimental and control groups on the areas of mathematics where they were tested.

Hypothesis II: There is no significant difference between the mean performance scores of students who were provided feedback and those without feedback in mathematics post-test.

Table 2: t-test analysis of difference between the mathematics post-test scores of students provided feedback and those without feedback.

Group	N	Mean	SD	Df	t_{cal}	t_{tab}	Decision
Experimental	50	17.40	1.38	98	6.88	1.98	S
Control	50	15.10	1.92				

P<0.05 level of significance   S = Significant

Table 2 revealed that the calculated value of t (6.88) was greater than the table value (1.98) at 0.05 level of significance. Consequently, a significant difference existed between the mean performance scores of students who received feedback and those without feedback in

mathematics post-test. The null hypothesis was therefore not upheld. Hence, there was a significant difference between the performance of respondents in experimental and control groups after treatment.

Hypothesis III: There is no significant difference between the mean post-test scores of male and female students who were provided with feedback in mathematics.

Table 3: t-test analysis of difference between the mathematics post-test scores of male and female students.

Group	N	Mean	SD	Df	t_{cal}	t_{tab}	Decision
Male	25	17.12	1.71	48	0.51	2.01	NS
Female	25	16.86	1.92				

P<0.05 level of significance   NS = Significant

Table 3 revealed that the calculated value (0.51) is less than the table value (2.01) at 5% level of significance. The implication here is that no significant difference existed between the mean post-test scores of male and female students in mathematics. The null hypothesis was therefore upheld. Hence, there was no significant difference between the performance of male and female students in the experimental group who took part in the post-test.

Discussion and conclusion

Table 1 revealed that the mean performance scores of students in the experimental group (12.00) was higher than the mean performance scores of students in the control group (11.85) with a mean difference of 0.15. The measure of variability (standard deviation) had a difference 0.2. The t-test analysis showed that no significant difference existed between the mean performance scores of students who received feedback and those without feedback in mathematics pre-test. This showed the homogeneity of both groups. Consequently, the null hypothesis was upheld. Hence, there was no significant difference between the performance of students in experimental and control groups in mathematics pre-test.

Table 2 revealed that the mean performance scores of students in the experimental group (17.40) was higher than the mean performance scores of students in the control group (15.10) with a mean difference of 2.3. The t-test analysis showed that a significant difference existed between the mean performance scores of students who received feedback and those without feedback in mathematics post-test. The difference could be attributed to the effect of the treatment on the students. The null hypothesis was therefore not upheld since the calculated value was greater than the critical value of t. Hence, there was a significant difference between

the performance of respondents in experimental and control groups after treatment. This aligned with the findings of Siewert, 2011).

Table 3 revealed that the mean performance scores of male students (17.12) was higher than the mean performance scores of female students (16.86) with a mean difference of 0.26. The measure of variability (standard deviation) had a difference of 0.21. The calculated value of t (0.51) was less than its table value (2.01) at 0.05 level of significance. It showed that there was insufficient evidence to suggest that the male students had a significantly different mean to the female students. Consequently, the null hypothesis was upheld. Hence, there was no significant difference between the mean post-test scores of male and female students who received feedback in mathematics. This agreed with the findings of Jegede, 2007; Gambari & Yusuf, 2014.

Recommendations

It is recommended that

1. Teachers should inculcate the habit of giving feedback to students as a means of instruction, correction, or appraisal.
2. Teachers should encourage students to make good use of certain feedbacks they receive.
3. Students should use the feedback they receive to bridge the gap between their current and desired levels of performance.

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