TECHNOLOGY AN EFFECTIVE TOOL FOR FORMATIVE ASSESSMENT AMONG RESEARCH STATISTICS STUDENTS IN HIGHER INSTITUTIONS IN PLATEAU STATE, NIGERIA

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Abstract
The aim of this research investigation is to ascertain the usefulness of technology as an effective tool for on-line formative assessment among undergraduate students in research statistics in Plateau State, Nigeria. The study was motivated by the observed poor performance of students in research statistics in higher institutions in Plateau State. To guide this study, three hypotheses were formulated and tested. The study adopted pretest- posttest experimental design, specifically with randomization. The sample consists of 77 undergraduate students (41 male and 36 female) in one higher institution. The students were randomly assigned to experimental (39) and control (38) groups. The experimental group was introduced to various online formative assessments with feedback together with normal lectures while the control group was taught the normal lecture method. The two groups were taught Research Statistics. Research Statistics Computer Based Test (RSCBT) alternate form tests were used to collect data. The reliability coefficients for the pre-test was 0.91 and the posttest recorded 0.89. The techniques employed in data analysis were means, standard deviations and t-tests. The study revealed that online formative assessment and feedback improved student's research statistics performance. Furthermore, the findings revealed that there was no significant effect on gender. It was recommended that undergraduate students should be exposed to regular online formative assessment and feedback as this can motivate students and improve learning.

Key Words: Technology, Tool, Formative Assessment, Research Statistics

Introduction

Technology is an integral part of our lives in this 21st century such that it helps learners understand course content and achieve good results in their course of study. The use of technology in education has brought about the use of digitized learning through learning tools like computers, iPods, Smartphone, smart digital white boards which could motivate students to learn at anywhere in an informal classroom.

In Education, Research Statistics is a course that every student must pass in order to graduate. It is taught in higher institutions by Research, Measurement and

Evaluation Lecturers. Some of these students have transferred their fear and anxiety in mathematics to this course such that they fail to obtain good grade in this course of study. In spite of the measure taken to teach this course, students still obtain poor performance in this course. According to Baleni (2015), utilizing various kinds of technological tools gives learners the sense of freedom, motivation and encouragement. It also makes teaching and learning more interesting and rewarding. Technology is empowering students to be more creative and more connected. It teaches learning through movement and plays, while encouraging collaboration and discussion. Most of undergraduate students perform poorly in research statistics; they showed a general weakness in their understanding of basic concepts in the course content and found it difficult to correctly apply certain concepts appropriately. This demonstrates clearly a lack of knowledge of some basic principles on the part of the students. These observations require that investigation be carried out on how to improve students' performance in research statistics Okolo, (2018).

Factors that lead to student's poor performance in mathematic related courses has been identified. Ajogbeje, Ojo and Ojo (2013) revealed that teacher's method of teaching contributed to the student's poor academic performance. Cassady and Gridley (2015), Okolo (2015) reported that anxiety could lead to student's poor academic performance. They also carried out researches on the use of formative assessment as strategies to reduce anxiety and improve students' academic performance. They reported that students who are systematically taught using formative assessment perform better than those who are taught using conventional methods. Research has suggested that formative assessment could improve both learning and examination results (Okolo, 2015 & 2018). Male and female students in most cases exhibit their strengths and weaknesses in mathematics/ statistics related courses. In the area of gender, research has been carried out by some researchers and found out that there is no significant difference in the scores of male and female students exposed to the formative assessment strategy (Okolo, 2015; Orherauata & Oyakhirome, 2019). Alovigba, Vershima, O'Kwu and Ijenkeli, (2012) found out that male performed better than female students. There is therefore, the need for further investigation of the effectiveness of online formative assessment based on gender.

Cassady and Gridley (2015), carried out a research on the effect of online formative and summative assessment on test anxiety and performance and the result revealed that students taking formative tests online reported lower levels of perceived test threat and benefited in their course examinations. In order for undergraduate students to perform better in research statistics they should be introduced to online formative assessment through the use of technological tools. Formative assessment is assessment for learning and can be used to improve performance in many different ways such as tracking student's progress over time. It is empowering students to be more creative and motivated to learn. Technology facilitates our ability to meet the needs of all kinds of learners by providing a variety of digital resources, whopping potential benefits such as the ability to customize

higher engagement in learning among students technological. Formative assessment is incorporated essentially to monitor students' progress and identify breaches and poor performances in order fix them and improve students' performance. This is basically for student's retention and for excellence in higher education. One of the benefits of technology is to enhance assessment. There are variety in the designs of formative assessment and feedback in research statistics online. This improves student's knowledge through interactive formative assessment with adaptive feedback online.Online formative assessment improves retention as well as failure rates reducing instances of malpractice and motivates students to learn in higher institutions of learning Mitra and Barua (2015).

Gikandi, Morrow and Davis (2011) carried out online formative assessment in higher education. The key findings are that effective online formative assessment can foster learners with valuable learning experiences. The entire premise behind formative assessment in e-Learning is to give learners the feedback they need to correct unfavourable learning behaviours and strengthen desirable behaviours. To obtain this learners must get the feedback they need immediately after they commit an error or carry out the negative behaviour, so that they can link to the constructive critics to the e-Learning event in question. Jung- Lung, Chou, and Chang (2011) in their study used 56 participants enrolling in a "human resources management" they were randomly assigned into experimental and control groups. The result of the study indicates that the use of formative assessment in e-learning revealed that learners in the experimental group were highly motivated and performed better than their counterparts in the control group in the level of cognition. The result showed that feedback was beneficial to learners.

Mitra and Barua (2015), carried out a study on effect of online formative assessment on summative performance in integrated musculoskeletal system module. Assessment on test anxiety and performance. The result revealed that the use of computer based formative test with automated feedback can be explored as an optional addition to the curriculum of undergraduate programme to improve the performance of the students. This is in line with this present study, which also introduced online formative assessment with feedback to investigate if it will improve students' performance in research statistics. They did not include instant feedback therefore, the need for this study. The online formative assessment explains to the students why they failed and presents the correct answers with feedback and certificate. The researcher's certificate when she passed all the assessment is attached herein. The aim of the study is to use technology as a tool to improve students' performance through online formative assessment and feedback.

Ogange, Agak, Odhiambo and Kiprotich (2018), carried out a research on students perceptions of the effectiveness of different types of formative assessment used during online learning environment. A 31-item questionnaire was used to obtain data on student perceptions. Results further indicated that students perceived more prompt feedback from peer assessment and computer-marked assessment compared to teacher marked assessment. The findings of the study supports that practitioners

in e-Learning should use formative assessment and feedback mechanisms more effectively as it improved student's engagement positively as well as learning outcomes.

The broad question is therefore raised to guide the study:

Research Question: To what extent can online formative assessment and feedback enhance student's learning and improve their performance in research statistics. To facilitate this investigation the following hypotheses were formulated and tested at 0.05 level of significance.

Research Hypotheses

1. There is no significant difference between the pretest research statistics performance means scores of students in the experimental and control groups.
2. There is no significant difference between the post-test research statistics performance means scores of students in the experimental and control groups.
3. There is no significant difference between the post-test research statistics performance mean scores of male and female students.

Methodology

This study adopted experimental design specifically the randomized pretest posttest control group design. The population of the study consists of all the 300 level students in the Faculty of Education in Plateau State University. The sample for the study was systematically selected from a population of 1,907 third year students. The choice of 300 level students was informed by the fact that they are a set that offer Research Statistics as one of their courses in the institution. A sample of 77 students were selected using purposive sampling technique. They are randomized into experimental and control groups using the result of the pretest to ensure the two groups are equivalent. The instrument used for data collection was Research Statistics Computer Based Test (RSCBT). They are made up of two structured alternate forms of tests. They are fifty multiple choice instruments in research statistics items for the pretest and post-test covering what the students were taught within six weeks. The researcher outlined the objectives and activities achievable at the end of the cause of study. The table of specification covering the content areas was used to ensure content validity of the instrument. Face and content validities were also established. The Kuder-Richardson method of reliability coefficient was used to estimate the internal consistency of the two tests. The reliability co- efficient of 0.91 and 0.89 were obtained for the pretest and posttest respectively.

The researcher selected 39 students to the experimental group and gave the websites for online practice after subjecting them to pre-test and recording their results. These students in the experimental group were exposed to regular online formative assessment with feedback. Learners were provided with objectives at the beginning of the eLearning lessons. The researcher meets with the learners to discuss expectations and assess their current knowledge based skills. The researcher

observed learners as they were completing online activities and assessed the proficiency and skill level of each individual. She also tracked the learners' progress using formative assessment. Those in the experimental group worked together to achieve their objectives as well as participation in their normal lectures. Learners were encouraged to reflect upon their own eLearning experience and determine their level of proficiency or knowledge mastery also. Some were given certificate after completion of the questions online. The researcher ensured that with the students obtained effective feedback from the online formative assessment and effected the correcting. This motivated the students to learn. Those in the control group were given the pretest with those in the experimental group, they were subjected only to the normal classroom lectures. Student in the treatment and control groups were taught same course content in class. At the end of the six weeks of the experiment the post test on RSCBT were administered to both the treatment and control groups. The posttest lasted for one hour. The pre-test results were compared to obtain the gain scores of the experimental and control groups. The students' scores in the two tests were scored out of hundred. Which was recorded in percentage. The data collected were analyzed using means, standard deviation and t-test techniques.

Results

Hypothesis One: There is no significant difference between the pre-test research statistics performance mean scores of students in the treatment (experimental) and control groups.

Table 1: The Result of t-test Analysis of Pre-test Research Statistics Performance Mean Scores of Students in the Treatment and Control Groups

Group	N	Means	SD	Df	t-cal	p-val
Experimental	39	25.44	3.52			
				75	-.92	.36
Control	38	24.76	2.85			

Table 1 shows that the research statistics performance of students in the experimental and control groups before online formative assessment were generally poor. It revealed that the result of those in control group scored($\bar{X}$= 24.76; SD 2.85) while those in the experimental grouped obtained ($\bar{X}$= 25.44 ; SD = 3.52) before the treatment. Most of the students were not familiar with the online formative assessment programme. The t test result showed that t= -.92, df =75 and p-value= .36. This revealed that the pre-test means scored of both the treatment and control group were equivalent. The difference between the two group are not significant since there

is no significant different in their scores. Its means that the performance of the two group before the experiment were the same. The result revealed that students should log in regularly to get used to computer based assessment

Hypothesis Two: There is no significant difference between the post-test research statistics performance mean scores of students in the treatment and control groups.

Table 2: The Result of t-test Analysis of Post-test Research Statistics Performance Mean Scores of Students in the Treatment and Control Groups

	N	Mean	SD	df	t-cal	p/val
Experimental	39	67.13	10.53	75	12.16	.000
Control	38	38.11	10.42			

The hypothesis was tested using t-test for independent samples to determine the different between the post test the mathematic performance mean scores of student in the treatment and control groups. The t-test analysis is presented in table 2.The post-test mathematics mean scores of students in the treatment and control groups shows that there was a significant difference between the mathematics performance mean scores of the treatment group. It revealed that those in the control group were ($\bar{X}$=38.11; SD= 10.42) while those in the experimental group obtained ($\bar{X}$=67.13; SD =10.53) after the experiment. Since the p-value .000 is less than the level of significant level we accept the hypothesis. It indicates that the regular formative assessment and feedback was effective on the treatment group against those of the control group. This shows that the use of technology as a tool for formative assessment improved the performance of students within the treatment group while the research statistics performance of those in the control group did not indicate any improvement. This further supports the assertion made earlier that technology as a tool for online formative assessment enhances learning and leads to improved performance of students in higher institutions.

Hypothesis Three: There is no significant difference between the post-test research statistics performance mean scores of male and female students.

Table 3: The analysis showing t-test for independent samples of research statistics performance mean scores of post-test of male and female students

Gender	N	Means	SD	df	t-cal	p-val
Female	36	54.42	16.89	75	-.74	.46
Male	41	51.39	18.9			

Table 3 shows the t-test result of the post-test research statistics mean scores of the male and female students. The result showed male ($\bar{X}$= 51.39; SD = 18.9) while the female result showed ($\bar{X}$= 54.42; SD = 16.89), with the p-value .46 is greater than level of significance 0.05. Therefore, the null hypothesis is accepted. This implies that there is no significant difference in the mean scores of male and female students in the experimental and control groups. This shows that the male and female students responded equally to the experiment, there is no difference in their performance.

Discussion of Findings

The findings from hypotheses one reveals the level of pre-test research statistics of students in the experimental and control groups were generally poor. It revealed that there is no significant difference between the experimental and control groups research statistics mean scores before the treatment. The students were generally weak in one-line formative assessment. This agrees with the fact that they were unable to score high before the treatment. Many of the students are not used to answering on-line test using their phones and others computers.

The findings of hypothesis two revealed that the result of the post-test of students in the experimental group after the treatment was remarkable. The result of this study revealed that the use of online formative assessment and feedback improved the students' performance. This is in line with the study of Cassady and Gridley (2015), which revealed that the use of online formative assessment improves learning. It agrees with the earlier findings of Okolo,(2015); Ajogbaje and Alonge, (2012); Okolo, (2018), that students who are systematically exposed to using formative assessment performed better than those taught using lecture method.

Findings from hypothesis three revealed that there is no significant difference between the post-test research statistics means scores of male and female students. The use of the treatment which is regular online formative assessment on both indicated no difference in the result of their performance after treatment. This implies that gender has no effect on students' performance in research statistics. It revealed that gender and treatment had no interaction effect. This finding agrees with Ajegboye, Ojo and Ojo (2013);Okolo,(2015), who found out that gender had shown no effect on students performance when formative assessment, feedback and remediation were used on both male and female students.

Conclusion

Technology is a major tool to use in order to improve students' performance in research statistics. The result of this study has revealed that on line formative assessment can be used with feedback to improve students' performance. The use of online formative assessment has equal effect on both male and female students in improving their performance in research statistics. Gender has no differential effect on the performance of students in higher institution.

Recommendations

1. Teachers should practice and be used to the online formative assessment as this can improve the teacher's knowledge of subject matter.
2. Teachers should also create awareness that there is on -line formative assessment
3. Lecturers should train their students on the use of on line formative assessment

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