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Effect of Bloom's taxonomy Blueprint Based Achievement Test on the Performance of Senior Secondary Students in Biology in ONDO STATE

AKINNODI, Oladamola Dickson
Department of Science Education,
Faculty of Education
Ekiti State University
Ado-Ekiti

ABSTRACT

The study examined the effect of Bloom's taxonomy blue-print based achievement test on the performance of senior secondary students in Biology. This study adopted quasi experimental pre-test and post-test two group design (one experimental and one control group). The targeted population for the study consisted of all the Senior Secondary School (S.S.S.) two students in public secondary schools in Ondo State. The sample consisted of 101 S.S.S. 2 students (class intact size) drawn from four public secondary schools in the two Senatorial Districts of Ondo State. The sample was selected using multistage sampling procedure. Standardized Test in Biology (STB) was used to collect relevant data for this study. It consisted of 50 objectives items with four options. The items covered all the topics to be taught for the 5 weeks. Item analysis was used to validate the STB which revealed that the difficulty index and discriminating power were moderate. The internal consistency method was used to establish the reliability of the STB using the KR-20 which yielded a Cronbach's Alpha of 0.84. The data collected for the study were analyzed using descriptive and inferential statistics. The findings of the study showed that the two groups were homogeneous at the commencement of the experiment. However, the use of Bloom's taxonomy blue-print based achievement test enhanced better performance of students in Biology than the conventional strategy after treatment. Bloom's taxonomy blue-print based achievement test was not gender biased. It was recommended among others that the use of Bloom's taxonomy blue-print based achievement test should be encouraged in Biology class in secondary schools so as to enhance better academic performance of students in Biology.

Keywords: Bloom's Taxonomy Blueprint, Performance, Students, Biology

Introduction

The part of science which studies living things is called Biology. Biology is the study of living things and concerns itself with the study of the behavior, distribution, structure, the origin of plants and animals and their relationship with their environments. Biology, like other science subjects in secondary schools is comprises of practical activities. In all the sciences, Biology is moved towards analying the theoretical content, so as to improve efficient instruction and learning of the subject (Kuncel, 2011).

In Sotco, Eugenia, Dorice and Ernest (2013) study, it revealed that the performance of Nigerian students in normal level Biology was largely poor; this is attributed to many factors of teaching strategy itself. Reports from Biology Chief Examiner's showed that students' performance in Biology in the external examinations is poor (Ige, 2009; Opara,2011; Nwagbo & Chukelu, 2018).

Putting students' performance in Biology into consideration, it appears that the poor performance is a replication of the standard of tests given to students which are mostly teacher made test. A test has a significant role in the teaching and learning process as an essential part of the instructional program that provides information that serves as a basis for a variety of educational decisions. A test can lead students' attention either toward or away from the purposes of instruction. Students encouragement can come from a test which enables them to focus on a limited aspect of the course content or direct their attention to all important areas (Kolawole, 2010).

In other to achieve the aims and objectives of education, the process of transferring the knowledge must be measured and assessed through a process of test determine the extent to which the educational aims is been attained by the students that represent the nation. In this situation the test must be well scheduled through the use of acceptable blue print. The achievement of any reform in the educational system is its ability to improve the attainment of learning result. The restructuring of the curriculum for human development and social responsibility is

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not just to provide access for students but also about developing critical competencies and knowledge for sustainable growth (Kolawole, 2010, Olofin, 2020).

The teacher-made test items given in the classroom are sometimes prepared or constructed, administered, and scored by one or a limited number of teachers. Teacher-made tests can be much more individualized. A teacher may decide to test students specifically on the subject matter he or she taught in class. They may also vary the amount of time permitted for their learners to take a test. It seems that teacher-made tests have been seemed to be hastily constructed or not constructed based on a test blue-print or table of specification. This is why the researcher is interested in assessing the effect of Bloom's taxonomy blue-print based achievement tests on students' performance in Biology.

A hierarchical structure representing six levels of thinking and learning skills that move from the lower level to higher order skills is Blooms Taxonomy. Bloom developed the original Taxonomy and was later revised by Anderson and Krathwohl in 2001 (Kolawole, 2010). The revised taxonomy was a modification of the original Taxonomy where the most notable of the variations is the change of nouns to action verbs, for example the knowledge changed to remember. The original Taxonomy had the levels: Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. In the revised Taxonomy, any purpose is represented in two dimensions in a two-dimensional table, which is termed as the Taxonomy Table.

Teachers are provided with a conceptual framework that promotes shared understanding and meaningful communication by Bloom's taxonomy table. It offers a means by which teachers can develop more complete thought of specific objectives and use this understanding to develop assessment and instruction and the essential link between them (Kolawole, 2010).

The point that the teachers in Nigeria secondary schools were generating test or instrument to measure students' academic performance does not mean that the teachers do not have problem at all in the course of setting or producing test items. Teachers made test seems to lack content and construct validity. In the light of this, the problem of the study was to assess the effect of Bloom's taxonomy blue-print based achievement test on the performance of senior secondary students in Biology. The study specifically examined:

i. *the performances of students in Biology when exposed to Bloom's taxonomy-based achievement test and teacher made an achievement test;*
ii. *the difference in the mean scores of the experimental group and control group at the commencement of the experiment;*
iii. *the difference in the post-test mean scores of students in Biology exposed to Bloom's taxonomy blue-print based achievement test and the control group; and*
iv*. the influence of gender on the academic performance of students exposed to Bloom's taxonomy blueprint-based achievement test*

Research Question

This research question was raised to guide the study:

1. What are the performances of students in Biology when exposed to Bloom's taxonomy-based achievement test and the teacher made an achievement test?

Research Hypotheses

The following null hypotheses were generated for this study:

1. There is no significant difference in the mean scores of the experimental group and control group at the commencement of the experiment
2. There is no significant difference in the post-test mean scores of students in Biology exposed to Bloom's taxonomy blue-print based achievement test and the control group
3. Gender will not significantly influence the academic performance of students exposed to Bloom's taxonomy blueprint-based achievement test.

Methodology

This study adopted a quasi-experimental pre-test and post-test two group designs (one experimental and one control group). The homogeneity was established by pre-test while the post-test was used after the treatment to measure students' performance. The pattern of the design is as shown below.

O_1 X_1 O_2: Experimental group
O_3 Xc O_4: Control group

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Where

O_1, O_3 – Observations before treatment
O_2, O_4 – Observations after treatment
X_1 – Treatment via Bloom's taxonomy blueprint-based test
Xc – Control group: Teacher made a test

The targeted population for the study consisted of all the Senior Secondary School (S.S.S.) two students in public secondary schools in Ondo State. The sample consisted of 101 S.S.S. 2 students (class intact size) drawn from four public secondary schools in the two Senatorial Districts of Ondo State. The sample was selected using multistage sampling procedure.

Standardized Test in Biology (STB) was used to collect relevant data for this study. STB consisted of section A and B, section A sought for the bio-data of the respondents which included the name of the school, identification number and students' gender. Section B of STB consisted of 50 objectives items with four options. The items covered all the topics to be taught for the 5 weeks.

Item analysis was used to validate the STB which revealed that the difficulty index and discriminating power were moderate. The internal consistency method was used to establish the reliability of the STB. It was administered on 30 respondents in one of the schools outside the sampled area. The data extracted was collated and analyzed using the KR-20 which yielded a Cronbach's Alpha of 0.84.

The data collected for this study were analyzed using descriptive and inferential statistics. The research questions were answered using means and standard deviation. Hypotheses 1-2 were tested using t-test while hypothesis 3 was tested using Univariate Analysis of Variance at 0.05 level of significance.

Experimental Procedure

The researcher obtained permission from the authorities of the four schools. A day workshop on the use and application of Bloom's taxonomy blueprint-based test was organized for the research assistants from the selected schools. The study was carried out in three phases:

Phase One: Pre-treatment Stage

The researcher administered the pre-test instrument to both experimental and control groups to ascertain the homogeneity of the two groups.

Phase Two: Treatment Stage

a) The experimental group (Bloom's taxonomy): The training package consisted of a lesson plan for teachers. Students were exposed to eighty minutes of teaching-learning and evaluation twice per week for five consecutive weeks. Students were involved in ten sessions consecutively using Bloom's taxonomy blueprint-based test to evaluate the students.

b) Control Group: Control group has no special treatment. They were taught using conventional methods twice per week for five weeks and the teacher made test was used to evaluate them.

Phase Three: Post-treatment Stage

At the end of the treatment stage, the instrument was re-administered on the students to determine the effects of the treatment on them.

Results

Question 1: What are the performances of students in Biology when exposed to Bloom's taxonomy-based achievement test and the teacher made an achievement test?

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Table 1: Mean and standard deviation of pre-test and post-test scores of students exposed to Bloom's taxonomy-based achievement test and teacher made achievement test

Strategies	Test	N	Mean( )	S.D	Mean Diff.
Bloom's taxonomy	Pre Test	53	43.24	2.56	**35.42**
	Post Test		78.66	5.75	
Conventional	Pre Test	48	43.47	2.50	**13.75**
	Post Test		57.22	5.12	
Total		**101**			

From Table 1, it is shown that the mean difference in students' performance in Biology between pre-test and post-test scores for Bloom's taxonomy-based achievement test is 35.42 and the conventional method (teacher made achievement test) is 13.75. It appears that the use of Bloom's taxonomy-based achievement test and teacher made an achievement test influences students' performance in Biology with Bloom's taxonomy-based achievement test being the more effective strategy. The graphical representation below further shows the more effective strategy in Biology evaluation.

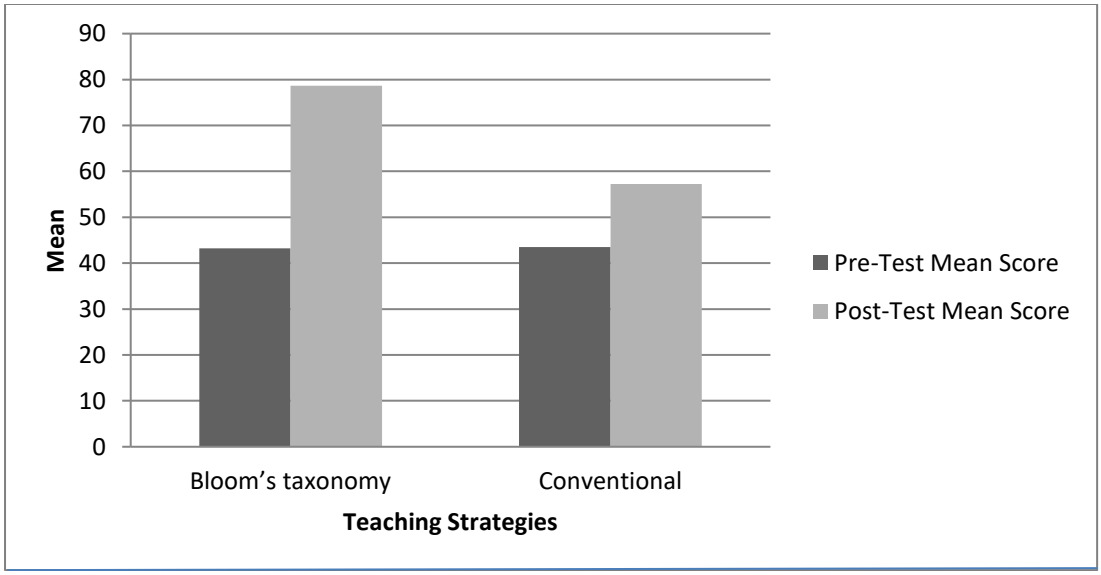

Figure i: Bar chart showing the performance of students exposed to experimental and control groups

Test of Hypotheses

Hypothesis 1: There is no significant difference in the mean scores of the experimental group and control group at the commencement of the experiment

Table 2: t-test analysis for difference in pre-test mean score of students in experimental and control groups

Variables	N	Mean	S.D	df	t-cal	p-value	Remark
Experimental	53	43.24	2.56	99	0.456	0.813	Not Significant
Control	48	43.47	2.50				

P>0.05

Table 2 showed that the t-cal (0.456) is not significant because the p-value of 0.813 > 0.05 at 0.05 level of significance. The null hypothesis is therefore not rejected. This implies that there is no significant difference in the

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mean scores of the experimental group and the control group at the commencement of the experiment. This implies that there is no significant difference in the pre-test mean score of students exposed to Bloom's taxonomy blue-print based achievement test and the control group. The students in the groups are homogeneous at the commencement of the study.

Hypothesis 2: There is no significant difference in the post-test mean scores of students in Biology exposed to Bloom's taxonomy blue-print based achievement test and the control group

Table 3: t-test analysis for difference in post-test mean score of students in experimental and control groups

Variables	N	Mean	S.D	df	t-cal	p-value	Remark
Experimental	53	78.66	5.75	99	19.822	0.000	Significant
Control	48	57.22	5.12				

*P<0.05

Table 3 showed that the t-cal (19.822) is significant because of the p-value of 0.000 < 0.05 at 0.05 level of significance. The null hypothesis is therefore rejected. This implies that there is a significant difference in the post-test mean scores of students in Biology exposed to Bloom's taxonomy blue-print based achievement test and the control group. The students in the experimental group performed better than those in the control group.

Hypothesis 3: Gender will not significantly influence the academic performance of students exposed to Bloom's taxonomy blueprint-based achievement test.

Table 4: Two-way Analysis of Variance (ANOVA) for effect of gender on academic performance of students exposed to Bloom's taxonomy blueprint-based test

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	684.788[a]	5	136.958	29.472*	.000
Intercept	72780.528	1	72780.528	15661.831*	.000
Gender	2.871	1	2.871	.643	.502
Performance	650.113	2	325.057	69.950*	.000
Gender *Performance	1.238	2	.619	.140	.816
Error	218.431	47	4.647		
Total	**177656.000**	**53**			
Corrected Total	**903.220**	**52**			

a. R Squared = .758 (Adjusted R Squared = .724) * P < 0.05

From Table 4, the p-value (0.816) is greater than 0.05 level of significant i.e. P (0.816)>0.05. This led to the non-rejection of the hypothesis. This means that gender will not significantly influence the academic performance of students exposed to Bloom's taxonomy blueprint-based test. Bloom's taxonomy blueprint-based test is not gender biased.

Discussion

The finding of this study revealed that, the performance of students in both experimental and control groups in pre-test were low and do not differ statistically. This finding established the homogeneity of the two groups involved in the study prior to the experiment. In other words, it could be said that the knowledge baseline for the two groups

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involved in the study are equal. Consequently, any significant difference documented afterwards would not be attributed to chance, but to the specific treatment applied.

The findings of this study revealed that there was significant difference in the post-test mean score of students in experimental and control groups. There was a better improvement in the performance of students resulting from their exposure to Bloom's taxonomy blue-print based achievement test. This implies that the introduction of Bloom's taxonomy blue-print based achievement test to the experimental groups made them to perform better than the control group that was not exposed to treatment. The findings of Cimer (2014) show that the application of Bloom's taxonomy blue-print based achievement test in some schools yielded better results than the conventional method. Likewise, the findings of Kolawole and Ojo (2016), Kolawole, Oladosu and Ajetunmobi (2013) show that blueprint-based test application in some schools yielded better results than the conventional method.

The finding also revealed that gender did not significantly influence the academic performance of students exposed to Bloom's taxonomy blueprint-based test. By implication, Bloom's taxonomy blue-print based achievement test is not gender biased because gender of the student has no influence on the academic performance of the students in Biology. The study conforms to Kolawole, Oladosu and Ajetunmobi (2013) who revealed that the mean scores of students did not differ significantly on the basis of gender. But the findings contradicted the report of Cimer (2014) who stated that gender influence performance of student in Biology evaluated with Bloom's Taxonomy.

Conclusion

Based on the findings of this study, it could be concluded that, the two groups were homogeneous at the commencement of the experiment. However, the use of Bloom's taxonomy blue-print based achievement test enhanced better performance of students in Biology than the conventional strategy after treatment. Bloom's taxonomy blue-print based achievement test was not gender biased.

Recommendations

Based on the findings of this study, the following recommendations were made;

1. The use of Bloom's taxonomy blue-print based achievement test should be encouraged in Biology class in secondary schools so as to enhance better academic performance of students in Biology.
2. Biology teachers should be given sufficient orientation through workshops to update their knowledge in the use of Bloom's taxonomy blue-print based achievement test.
3. Authors of Biology textbooks should adopt Bloom's taxonomy blue-print based achievement test in evaluating all chapters of their book.

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