Impacts of Assessment for Learning Strategies on Students' Interest in Biology in Senior Secondary Schools in Maiduguri, Nigeria

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Abstract
This study investigated the impacts of assessment for learning strategies (AFLS) on students' interest in SS III biology students in Maiduguri, employing quasi experimental non-equivalent pretest- posttest control group design. Among some of the objectives was to determine the impacts of AFLS on students' interest toward genetics. A sample of 139 SS III students drawn from four intact classes selected from two randomly sampled schools were used in the study using a simple random sampling technique. The experimental group was subjected to treatment using AFLS while the control group was taught without AFLS. An Instruments known as Genetics Interest Questionnaire (GIQ) constructed by the researcher was used for data collection. The data collected were analyzed using simple percentage, mean and standard deviation for research questions and t-test for independent samples and dependent samples were used for testing the hypotheses. The major findings among others was that there is a significant difference between the interest mean scores of students exposed to AFLS and those not exposed to AFLS. Also the study shows that AFLS was found to enhance and facilitate students' interest in learning genetics aspect of biology. On the basis of the findings, some recommendations were made, one of which was that teachers should adopt AFLS to teach their students genetics and other topics in biology.

Keywords: *Assessment for Learning Strategy (AFLS), Interest, Gender and Biology (Genetics)*

Introduction

The Nigerian government recognizes the importance and value of education in general and science education in particular for her technological advancement as a nation. The knowledge of science is important because science is put to practice in almost every sphere of life, for instance, students' understanding of science allows them to deal with the social and biological issues that affects them at home or in the wider environment. Usman (2010) saw science as an intellectual activity carried out by humans, designed to discover information about the natural world in which they live and to discover the ways in which the information can be organized to benefit the human race. Science has become such an indispensable tool that no nation developed or developing, wishing to progress in its socio-economic sphere will afford to

relegate the learning of science in schools. Science comprises the basic disciplines such as Biology, Chemistry, Physics and Mathematics. The Federal Ministry of Education (FME), (2013) identifies biology among the core-science subjects offered at the Senior School Certificate Examination (SSCE) level. This is as result of the relevance of biology to individuals and the society.

Biology is the study of living things and their vital process and the study of life in general (Sarojini, 2010). It is a branch of natural science that deals with the study of living organism, including their structures, functioning, evolution, distribution and interrelations. It is also a natural science subject consisting of contents from microscopic organism to the biosphere which encompass the earth's surface and all living things (Okwo & Tartiyus, 2004). It is a standard subject at all levels of education because it is relevant to man's life (Akindele, 2003).The significance of biology as identified by Maduabum (2009) is that it enables individuals to: Understand and appreciating life, bring into focus the need to maintain good health, helping individuals to understand the parts of his/her body and their functions, promoting the individual for choice of careers, enabling one to question superstition due to sustained interest arising from comprehension of the cause of events, impact factual knowledge and stimulates scientific reflective thinking so as to produce a better informed individual, inculcate in the individual scientific skills and attitude in his approach to personal and social problems.

Biology stands as the bedrock for many other science courses like medicine, pharmacy, nursing, biochemistry, genetics, and agriculture among others that are of great economic importance to any nation. Genetics as one of the focus in this research refers to the branch of biology that deals with the process or mechanism of heredity, while heredity is the passing on of traits from parents to their offspring. Genetics as defined by Tamarin (2007) is the science which seeks to account for resemblances and differences exhibited among organisms related by descent. Parents pass traits to their young ones through gene transmission; genes are located on chromosomes and consist of deoxyribonucleic acid (DNA). The chromosome is made up of a specific instruction for protein synthesis. Children inherit their biological parent genes that express specific traits such as some physical characteristics, natural talent and genetic disorders.

In genetics, students learn and understand how traits or characteristics are being transmitted from parents to their offspring from one generation to another. These are assessed by both classroom teachers as internal examiners and by external examination bodies to ascertain students 'level of mastery of the contents of the subject. Unlike the internal examination, the external examination is conducted by the examining bodies such as West African Examination Council (WAEC), National Examination Council (NECO) and National Business and Technical Examination Board (NABTEB). In spite of the importance of biology, the results of students' performance in most of the certificate examinations like WAEC and NECO have not been encouraging. The chief examiners reports of both WAEC and NECO (2013-2016) on students' performance in biology was not encouraging (Ugwuadu, 2017). It was found that students had difficulty in learning some biology concepts such as genetics, evolution, and ecology among others which pose unique and formidable challenges to the students (Oyovwi, 2015). Various reasons have been attributed to the poor achievement of students in biology by different scholars. Research (Mamalanga and Awelani, 2014) found that the possible factors responsible for the poor performance included lack of financial support, lack of equipped libraries, lack of laboratories and Biology textbooks.

In order to overcome these challenges, the Assessment Reform Group (ARG, 2002) suggested that the use of Assessment for Learning Strategies (AFLS) throughout instruction might have significant impact on improving learning. This is because AFLS is the assessment for which the first priority in its design and practice is to serve the purpose of monitoring and

promoting student's learning. It thus differs from assessment designed primarily to serve the purposes of accountability, ranking or of certifying students based on competence. The ARG (2002) defined AFLS as the process of seeking and interpreting evidence for use by learners and their teachers to decide where the learners are in their learning, where they need to go and how best to get there. AFLS encompasses strategies that teachers engage during teaching and learning. These strategies includes: appropriate use of questioning, effective teachers' feedback, peer feedback, student self-assessment and formative use of summative assessment. These strategies promote students' interest and understanding of their own learning goals and expected performance. Particularly, these strategies were used to ascertain how they stimulate and facilitate students' interest toward genetics.

Therefore, it is important to investigate the impacts of AFLS on students' interest. Interest refers to the way students are willing to and ready or have the zeal for doing something. It is the state of willingness individuals have in attending to something. Essien, Akpan and Obot (2015) define interest as the focusing of the sense organs on or giving attention to some person, activity, situation or object. While Magnus (2008) posits that interest encompasses the positive pleasant feelings an individual has when trying to study a subject-matter. Abande, (2010) further opined that interest is a state of curiosity or concern about something or the attention given to something. The foregoing definitions imply that interest governs our feelings and attitude toward a particular thing or activity. Thus, the present study determines whether AFLS have any significant effect on the SS III students' interest in biology.

Another variable intended to be considered by the study include the influence of gender on students' interest in biology. This is because the secondary school population constitute of males and females as students. Gender is one factor identified in literature to have considerable effects on students' interest and academic performances especially in the science subjects (Adigun, Onihuwa, Irunokhai, Sada & Adesina, 2015). Furthermore, they defined gender as the range of physical, biological, mental and behavioural characteristics pertaining to and differentiating between the feminine and masculine (female and male) population. Gender differences in science have been observed among educators and researchers and different perceptions regarding gender, interest and achievements have been reported. This study therefore, is geared towards finding out if the use of AFLS could bring a solution to the problem of students finding difficulty in understanding genetics in biology and also contribute to the academic debate on the influence of gender on students' interest in biology (Science).

Objectives of the Study

The aim of the study was to investigate the impacts of assessment for learning strategies on students' interest in biology in senior secondary schools in Maiduguri. Specifically, the study's objectives were to:

1. Determine the effect of AFLS on students' interest in genetics aspect of biology.
2. Compare the nature of interest of the experimental and control groups in genetics before and after exposure to AFLS.
3. Examine the effects of gender on genetics mean interest score of the experimental group after exposure to AFLS.

Research Questions

The following research questions were formulated to guide the study:

1. What is the nature of the students' interest in genetics before exposure to treatment?
2. What is the students' interest in genetics after exposure to AFLS?

Research Hypotheses

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

1. There is no significance difference between the genetic interest of the experimental and control groups before exposure to AFLS.
2. There is no significant difference between the post-test interest mean scores of the SS III students in the experimental and control groups.
3. There is no significant difference in the post-test interest mean scores between male and female SS III students in the experimental group.

Method

Research Design

The study adopted the quasi-experimental design, specifically the non – equivalent pretest – post-test control group design. The quasi-experimental design is that in which randomization of subjects to experimental and control group is not carried out deliberately (Awotunde & Ugodulunwa, 2004). The choice of the quasi experimental design in preference to true experimental design is because some schools may not allow disruption and manipulation of their conventional class structures as required for a true experimental design in which students are randomly assigned to either experimental or control group. This design is considered appropriate because it will establish the cause - effect relationship between the independent variable (AFLS) and the dependent variables (interest).

Population and Sample

Population

The population of this study consisted of 9585 (5149 public and 4436 private schools) SS III biology students from 43 senior secondary schools in Maiduguri was used as obtained from Borno state ministry of education.

Sample

The sample for this study comprised of two senior secondary schools selected from the 43 secondary schools in Maiduguri that meet the criteria for the study. This implied that two intact classes were selected from each of the two randomly drawn schools making it four intact classes in all. The four classes are randomly assigned to experimental and control group for both schools. Therefore, the sample of this study comprised of one hundred and thirty-nine (139) SS III students, where 72 students made up the experimental group and 67 students made up the control group.

Sampling Techniques

The study adopted the simple random sampling technique. In the first place, the simple random sampling technique was used to select one school from the 5 qualified public schools using lottery method and likewise one school was selected from 38 qualified private schools making it two sampled schools by lottery method of sampling without replacement. This was done by associating a number to each of the qualified schools serially; the serial numbers were then recorded on pieces of paper, folded and mixed thoroughly before picking the two sampled schools. These two randomly selected schools were randomly assigned to experimental and control groups.

Instrument for Data Collection

The instrument used for data collection is Genetics Interest questionnaire (GIQ). The instrument consisted of 15 statements on interest in genetics based on the topic, this was measured on a five point Likert type interest rating scale developed by the researchers. The

five-point Likert rating scale was used to enable the students indicate their level of interest in genetics by responding as follows; SA = Strongly Agree, A = Agree, U = Undecided, D = Disagree and SD = Strongly Disagree. The GIQ was scored on a 5 – point scale, where strongly agree carries 5 point, agree carries 4 points, undecided carries 3 point, disagree carries 2 points and 1 point for strongly disagree.

Instrument Validity and Reliability

After developing the GIQ, it was subjected to the scrutiny and judgment of three experts, one from Psychology education, one from Biology education and Test and Measurement department of education foundation, Federal College of Education, Pankshin. They were required to scrutinize the items in terms of how adequate the items measure the construct interest in genetics without assessing a different construct that is not the concern of the present study, make corrections or suggestion where necessary and was further subjected to construct validity to determine the factor loadings of the GIQ items using the SPSS software**.** For reliability test, the internal consistency of GIQ was determined using Cronbach Alpha method, as it is suitable for test items of varying point values, interest or attitude scale (Likert scale) which are scored polychotomously. The result yielded 0.68 reliability coefficient which confirmed the reliability of the instrument.

Procedure for Data Collection

The researcher obtained a letter of introduction from the department of educational foundation, University of Jos, and presented it to the principals of the two sampled schools used for the study, seeking for permission to use their schools, students and teachers. Four research assistants who were Biology teachers of the sampled schools were used for the study. The researcher trained the research assistants on the necessary technique required for teaching the students through AFLS for the experimental groups while those in the control groups used the lectured method. Both the experimental and control groups received the instruction within four weeks using the normal periods on the school time table, and the lesson plans developed by the researcher for both the experimental and control groups. After the training, the researcher assesses the research assistants (teachers) by allowing them to demonstrate what they have been taught in the training and also monitors them during the administration of treatment.

Administration of Pre-test

The GIQ was administered using the face to face method. The GIQ was administered to the students by the research assistant whom are the biology teachers from the schools with the help of the researchers. The completed questionnaire was collected on the spot and scored by the researchers.

Administration of Treatment

The normal lesson period assigned to teaching biology in the school time table was used to teach both the experimental and control groups. The experimental group was taught using AFLS while the control group was taught using the lectured method. After the treatment/teaching, the GIQ were again administered to the control and experimental groups. The scripts were collected and scored by the researchers.

Administration of Post-test

The same instrument administered as pre-test was also administered as the post-test to the two groups (experimental and control) to ascertain the students' level of interest in the two groups, after exposure to different conditions. This was to establish the gain scores of the students from the two groups after the completion of treatment on the sub–topics contained in the GIQ.

Method of Data Analysis

The data obtained from the pre-test and post-test were analyzed using descriptive and inferential statistics. Simple percentage, mean and standard deviation were used to answer the research questions while t-test for independent samples was used to test the hypotheses at 0.05 level of significance.

Results

Research Question One

What is the nature of students' interest in genetics before exposure to treatment?

To answer this research question, the students' scores on the Genetics Interest questionnaire (GIQ) of the experimental and control groups were used and the result are presented in Table 1 and 2.

Table 1

Results of the experimental group students' nature of interest in genetics before exposure to treatment.

S/N	Items	Total Score	$\bar{X}$	SD
1	Genetics is one of the topic I like most in biology	149	2.24	.906
2	I like to learn more about genetics	112	1.67	.786
3	I hate genetics lesson because it confuses me	209	3.09	.917
4	I prefer reading genetics than other topic in biology	139	2.06	.715
5	I am interested in genetics because it enlightens me about human reproduction	142	2.16	.828
6	Genetics will help me in my future career	135	1.85	.821
7	I always like to be in class whenever genetics topic is taught	134	1.99	.929
8	Genetics is one of the topics I hate most in biology	138	2.13	.869
9	Genetics lessons are lively and practical	222	3.27	1.067
10	Genetics lessons are dull and boring to me	129	1.79	0.845
11	I like answering questions in genetics lessons	131	1.82	.626
12	I am less attentive during genetics lessons	133	2.03	.969
13	I like discussing genetics with my classmates	140	2.10	.761
14	I like asking questions in genetics lessons	127	1.90	.781
15	I like doing my assignment on genetics	156	2.87	.776

Table 1 reveal responses on the students' interest in genetics before exposure to treatment. The result indicated that students' responses to item 3 and 9 with total scores of 209 and 222 had moderate interest within the criterion score range of 201 – 267. And items 1, 2, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14 and 15 with total scores of 149, 112, 139, 142, 135, 134, 137, 122, 125, 133, 140, 129, and 156 had low interest toward genetics within the criterion score range of 0 – 200. Indicating that, students have low interest toward genetics before exposure to treatment.

Table 2
Results of the control group students' on the nature of interest in genetics before exposure to treatment

S/N	Items	Total Score	$\overline{X}$	SD
1	Genetics is one of the topic I like most in biology	142	1.97	.839
2	I like to learn more about genetics	125	1.74	.692
3	I hate genetics lesson because it confuse me	239	3.32	.819
4	I prefer reading genetics than other topic in biology	138	1.90	.735
5	I am interested in genetics because it enlightens me about human reproduction	135	1.90	.695
6	Genetics will help me in my future career	126	1.71	.680
7	I always like to be in class whenever genetics topic is taught	140	1.97	.949
8	Genetics is one of the topics I hate most in biology	242	3.25	1.017
9	Genetics lessons are lively and practical	152	2.03	.804
10	Genetics lessons are dull and boring to me	125	1.76	.760
11	I like answering questions in genetics lessons	134	1.85	.763
12	I am less attentive during genetics lessons	149	2.10	.842
13	I like discussing genetics with my classmates	148	2.03	.839
14	I like asking questions in genetics lessons	144	2.03	.804
15	I like doing my assignment on genetics	126	1.76	.778

Table 2 reveals responses on the students' interest in genetics before exposure to treatment. The result indicated that students' responses to item 3 and 8 with total scores of 239 and 242

had moderate interest within the criterion score range of 216 – 287. And items 1, 2, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14 and 15 with total scores of 142, 125, 138, 135,126, 140, 152, 129, 134, 148,144 and 126 had low interest toward genetics within the criterion score 0 – 215. Indicating that, students have low interest toward genetics before exposure to treatment.

Research Question Two

What is the students' interest in genetics after exposure to AFLS?

This research question was answered using the students' scores obtained from the Genetics Interest Questionnaire (GIQ) of the experimental and control groups after expose to AFLS and the result are presented in Tables 3 and 4.

Table 3

Results of the experimental group student interest in genetics after exposure to AFLS

S/N	Items	Total Score	X	SD
1	Genetics is one of the topic I like most in biology	250	3.76	1.182
2	I like to learn more about genetics	247	3.76	.986
3	I hate genetics lesson because it confuse me	241	3.72	.982
4	I prefer reading genetics than other topic in biology	240	3.58	1.183
5	I am interested in genetics because it enlightens me about human reproduction	242	3.61	1.154
6	Genetics will help me in my future career	269	3.90	1.046
7	I always like to be in class whenever genetics topic is taught	244	3.66	1.297
8	Genetics is one of the topics I hate most in biology	240	3.57	1.209
9	Genetics lessons are lively and practical	239	3.57	1.209
10	Genetics lessons are dull and boring to me	152	2.30	1.015
11	I like answering questions in genetics lessons	241	3.57	1.282
12	I am less attentive during genetics lessons	256	3.78	1.204
13	I like discussing genetics with my classmates	145	3.64	1.190
14	I like asking questions in genetics lessons	143	2.21	1.023
15	I like doing my assignment on genetics	254	3.85	1.118

Table 3 shows the responses of students' interest in genetics after exposure to AFLS. The result indicated that students' responses to item 10, 13, and 14 with each having a total score of 152, 145 and 143 had low interest within the range of a criterion score of 0 -200. Item 1, 2, 3, 4, 5, 7, 8, 9, 11, 12, and 15 with each total score of 250, 247, 241, 240, 242, 244, 240, 239, 241, 256, and 254 had moderate interest within the criterion score range of 201 – 267. While item 6 had high interest toward genetics within the criterion score range of 268 - 335.

Table 4
Results of the control group students' interest in genetics after exposure to AFLS

S/N	Items	Total Score	$\overline{X}$	SD
1	Genetics is one of the topics I like most in biology	241	3.65	1.014
2	I like to learn more about genetics	197	2.75	.989
3	I hate genetics lesson because it confuse me	138	1.99	1.014
4	I prefer reading genetics than other topic in biology	163	2.26.	1.175
5	I am interested in genetics because it enlightens me about human reproduction	225	2.09	1.044
6	Genetics will help me in my future career	218	3.04	1.054
7	I always like to be in class whenever genetics topic is taught	234	3.19	1.170
8	Genetics is one of the topics I hate most in biology	237	3.21	1.098
9	Genetics lessons are lively and practical	193	2.79	1.047
10	Genetics lessons are dull and boring to me	154	2.18	1.053
11	I like answering questions in genetics lessons	165	2.76	1.107
12	I am less attentive during genetics lessons	154	2.18	1.025
13	I like discussing genetics with my classmates	181	2.92	1.110
14	I like asking questions in genetics lessons	216	3.00	1.110
15	I like doing my assignment on genetics	220	3.12	1.048

Table 4 shows the responses of students' interest in genetics after exposure to AFLS. The result indicated that students' responses to item 2, 3, 4, 9, 10, 11, 12, and 13 with each having a total score of 197, 138, 163, 193, 154, 165, 154, and 181 had low interest within the range of a criterion score of 0 -215. And item 1, 5, 6, 7, 8, 14, and 15 with each total score of 241, 225, 218, 234, 237, 216, and 220 had moderate interest within the criterion score range of 216 – 287.

Hypothesis One
There is no significant difference between the genetic interest of the experimental and control groups before exposure to AFLS.
This research hypothesis was tested using t-test for independent samples and the result is presented in Table 5.

Table 5
Result of t-test analysis for difference between the genetic interest of the experimental and control groups before exposure to AFLS

Group	N	M	SD	DF	T	P-value	Decision
Experimental	67	31.97	3.380	137	-1.161	0.248	Not Sig.
Control	72	31.32	3.228				

$p>0.05$
Table 5 reveals that the pre-test interest mean score of the control and the experimental groups were subjected to t-test for independent samples. The result indicated that, no statistically significant difference exists between the pre-test interests mean score of the control and the experimental groups. Since mean for the control group (M = 31.32, SD = 3.228) was almost the same with pre-test of the experimental group (M = 31.97; SD = 3.380); t (137) = 1.161, p >.05. Since the p-value of 0.248 is greater than 0.05 level of significance, the null hypothesis was accepted. It was concluded that the interest mean score of control group was not significantly different from that of experimental group before exposure to AFLS.

Hypothesis Two

There is no significant difference between the post-test interest mean score of the SS III students in the experimental and control groups. This research hypothesis was tested using t-test for independent samples and the result is presented in Table 6.

Table 6

Result of t-test analysis for difference between the post-test interest mean score of the SS III students in the experimental and control groups

Group	N	M	SD	Df	T	P-value	Decision
Experimental	67	49.81	4.698	137	-12.488	0.000	Sig.
Control	72	40.39	4.191				

$p<0.05$

Table 6 shows that the post-test interest mean scores of the experimental and control groups were subjected to t-test for independent samples. The result indicated that statistical difference exists between the post-test interest mean scores of students in the experimental and control groups. The mean score of the post-test experimental group is (M=49.81; SD = 4.698) while that of post-test control group is (M = 40.39; SD = 4.191). $t(137) = -12.488$, $p<0.05$. Since the p-value of 0.000 is less than 0.05 level of significance, the null hypothesis was rejected. Therefore, it was concluded that the mean interest score of the post-test experimental group was significantly different from the post-test control group.

Hypothesis Three

There is no significant difference between the post-test interest mean scores of male and female SS III students in the experimental group. This research hypothesis was tested using t-test for independent samples and the result is presented in Table 7.

Table 7

Result of t-test analysis for difference in the post-test interest mean scores of the male and female SS III students in the experimental group

Group	Gender	N	M	SD	Df	t	P-value	Decision
Experimental	Male	45	50.04	4.690	65	0.591	0.556	Not Sig.
Experimental	Female	22	49.32	4.785				

$p>0.05$

The data in table 10 shows that the genetics interests mean scores of the male and female students in the experimental group were subjected to t-test for independent samples. The result indicated that no statistically significant difference exists between the male and female students in the experimental group after exposure to AFLS. The male interest mean score (M=50.04; SD=4.690) was almost same with the female students (M=49.32; SD=4.785); $t(65) = 0.591$, $p>0.05$. Since the p-value of 0.556 is greater than 0.05 level of significant, the null hypothesis was accepted. It was concluded that the mean interest scores of the male students was not significantly different from their female counterpart.

Discussion

The findings on table 6 showed that students exposed to AFLS had a higher mean interest score than those not exposed to AFLS. The result of t-test analysis for difference between mean scores of students from the experimental and control groups showed that the students exposed

to AFLS (the experimental group) recorded high mean interest scores of 49.81 which are greater than those not exposed to AFLS (the control group) with a mean of 40.39. This implies that the use of AFLS in teaching genetics facilitated students' interest in genetics. The finding is in line with Yusuf (2011) who observed that assessment supported instruction model (ASIM) was effective in facilitating interest.

The findings on gender difference presented in Tables 2 and 7 indicated that gender was not a significant factor on students' interest in genetics after they have been exposed to ALFS. It means that there was no significant difference in interest means scores of the male and female students exposed to the treatment.

Conclusion

From the findings of the study, assessment for learning strategies (AFLS) is an instructional strategy that has high potential in stimulating students' interest thereby improving their achievement in genetics. Students in experimental group who were exposed to AFLS recorded great improvement in their interest toward genetics after they were exposed to the treatment while gender did not influence the student's interest in genetics because the findings revealed that there was no significant difference between the interests mean scores of the male and female students after exposure to AFLS. Hence the adoption of AFLS in teaching genetics by biology teachers would help in stimulating students' interest in biology (genetics).

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Teachers should adopt Assessment for learning strategies to teach their students genetics and other topics in biology.
2. Students should be involved in the AFLS process.

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