International Journal of Multidisciplinary Research and Development
Online ISSN: 2349-4182, Print ISSN: 2349-5979
Impact Factor: RJIF 5.72
Received: 09-08-2018; Accepted: 04-09-2018
www.allsubjectjournal.com
Volume 5 Issue 9; September 2018; Page No. 28-32

Effect of blended learning and discussion instructions on students' performance in genetics

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Abstract
This study investigated the effects of blended learning instructional approach and discussion method on the performance of Senior Secondary School 2 Biology Students in Eleme Local Government Area of Rivers State. Three schools were selected purposively based on certain criteria. Quasi experimental design was adopted comprising of two experimental and one control groups. A total of 115 students constituted the study sample. Three research questions and three hypotheses guided the study. The instrument for data collection was a researcher made test tagged "Genetics Performance Test (GPT)" made of 50 items. The instrument was validated, reliability coefficient of 0.81was obtained using test retest method. The experimental groups were taught using YouTube and collaborative approaches while control was taught using discussion method with validated lesson packages. The result showed that students taught using blended instructions performed better than those taught using discussion method. However, the null hypotheses tested at 0.05 level of significance showed that there is no significant difference with respect to gender in the performance of students taught genetics using YouTube, collaborative and discussion methods respectively. The study recommended that Biology teachers should employ YouTube and collaborative methods in teaching genetics as a concept in Biology.

Keywords: blended learning, instructional approach, discussion method, genetics, YouTube

Introduction

The shift from teacher-centred approach which is characterized by traditional method to the students-centred approach is the main focus of Science Educators. This is an era of Science and Technology where Science is the backbone for the development of technology of a nation. The National Policy on Education by the Federal Government of Nigeria emphasized on Information and Communication Technology (ICT) and Science Education at all levels of Education in order to trigger students' curiosity in scientific inquiry, understanding scientific concepts and process to make Nigeria a key player in the formation technology society by the year 2015 (Anthony, 2012). Biology is recognized as one of the core Science subjects offered at the senior secondary schools level in Nigeria. It is the most preferred science subject both among science and non-science students. This is attested to by the large students' enrolment for Biology compared to Chemistry and Physics in Senior Secondary Certificate (SSCE) (WAEC, 2014) [13].

Blended learning is a learning model which integrates ICT based learning (online) with face to face learning (Graham, 2013) [6]. Blended learning can be described as the process of blending traditional roles of teachers with the roles of the e-teacher in class. Therefore, blended learning is a form of learning that combines or integrates traditional and electronic learning.

Blended learning is a strategy which combines both the direct learning through the internet as well as indirect learning. The direct e-learning is occasionally mixed together to include the use of intra-and internet, while indirect learning is that which is used in traditional classes. By way of example of this type of learning is a form of learning scheme which offers educational materials and detailed study of sources on the web, whereas the teacher offers support and guidance which is necessary during the instructional training and periods (Graham, 2013) [6].

Several definitions of blended learning were proposed in this study. Lewis and Parsad (2008) [8] blended learning as an integration of online and in-class instruction with reduced in-class time for students. Graham (2013) [6] opined that blended learning is a modern method of instruction delivery which largely depends on technology and the application of instructional strategies appropriate for solving problems related to class management and the learning directed activities that need accuracy and mastery. It will not be wrong therefore to infer that blended learning is instructional strategy which combines or integrates computer technology and the traditional methods or techniques that are familiar to teachers. Graham (2013) [6] viewed blended learning as a type of learning which integrates Information and Communication Technology (ICT) based learning (online) with face-to-face learning. According to a study in United States of America, blended design was one of the immediate driving forces for the adoption of technology in higher education (Adams Becker, Cummins, Davies, Freeman, Hall, Anaathanarayanan, 2017).

Blended learning offers driving impetus to classify the features of digital technology in general and Information, Communication Technologies (ICTs) more specifically. Propositions of a solution by Alan Turing; according to Floridi

(2014) [5], digital information communication technologies is capable of processing information independently in a way similar to humans and other Biological lives. Information Communication Technologies can as well pass information to one another without human interruption, but as programmed by humans (Floridi, 2014) [5]. Now than ever before, the educational world is controlled by information and the world economies rely squarely on that asset. Thus the world is perceived to be blended also and the blend is so overwhelming to the extent that individuals' constituents of the blend are difficult to see anymore. Again Floridi (2014) [5] is of the opinion that the world can now be seen as an "infosphere" just like biosphere in which humans inhabit as "inforgs", that the reality is obvious movement and transition from the physical and unchangeable to those things with which humans interact.

Studies on blended learning pointed to the fact that blended learning results in enhancement of students' performance, (Means, Toyama, Murphy & Baki, 2013) [9]. Educators prefer to involve Computer in instructional delivery in education believing that using computer will be an advantage due to the fact that the Computer is more effective as an educational device or tool compared with other tools (Dringus & Seagull, 2015; Bloemer & Swan, 2015) [4]. Computer offers students the opportunity to educate themselves, provides assistance for students who have learning difficulties in an attractive way. The traditional educational system present the teacher as the major reservoir and key player in teaching and learning, and that the entire operation of teaching falls completely on the teacher. However, in blended learning, teachers represent one of the tools that are provided by the educational sector in this case Ministry of Education.

Aim and objectives of the study

The aim of the study is to investigate effects of blended instructions (YouTube, collaborative) and discussion instruction on the performance of secondary school students in genetics in Rivers State. Specifically, the study sought to:

1. Compare the performance of students taught using YouTube, collaborative and discussion methods in genetics.
2. Investigate the mean performance of male students taught genetics using YouTube and discussion methods.
3. Investigate if the mean performance of female students taught genetics using YouTube differ from the female counterparts taught using discussion method.

Research questions

The study was guided by the following research questions;

1. What is the difference in the performance of the students taught genetics with YouTube, collaborative and discussion instructions?
2. How does the performance of male students taught genetics using YouTube instruction differ when taught using discussion method?
3. What is the mean difference in the performance of female students taught using YouTube when taught using discussion method?

Research hypotheses

The following null hypotheses were generated to guide the study

$H0_1$: There is no significant difference in the performance of students taught genetics using YouTube, collaborative and discussion instructions.

$H0_2$: There is no significant difference in the mean score of male students taught genetics using YouTube and when taught using discussion method.

$H0_3$: There is no significant difference in the mean scores of female students taught using YouTube and when taught using discussion method.

Methodology

Quasi-experimental, non-randomized pretest, posttest design was adopted. The experimental and control groups were in their intact classes. All Senior Secondary School Two (SS2) Biology students in Eleme Local Government Area totaling 280 (source: School Register) constituted the study population. Purposive sampling technique was adopted to select 3 schools. 115 students constituted the sample size randomly assigned three groups: two experimental and one control groups respectively. The experimented groups were taught using blended learning instructions namely; YouTube and collaborative while the control was taught using discussion method.

Research instrument tagged "Genetics Achievement Test (GAT)" constructed by the researcher made up of 50 items was used to collect data. The instrument was validated by experts in Genetics and Science Education with a reliability coefficient of 0.81. Genetics Achievement Test (GAT) was administered as pretest before treatment. The samples were taught the concept of genetics using a prepared and validated lesson packages in the three selected schools for three weeks. At the expiration of three weeks, the three groups were post tested with re-shuffled GAT. The test scripts were retrieved and counted on the spot by both the researcher.

Data obtained were analyzed using mean and standard deviation for research questions and analysis of covariance (ANCOVA) to test the significant difference (hypotheses).

Results and Discussions

The following results were obtained:

Research Question 1

What is the difference in the performance of the students taught genetics with discussion method, YouTube and collaborative instructions?

Table 1: Mean score of the students taught genetics with discussion differ from those taught using YouTube and collaborative instructions.

Model	N	Pre-test Mean	SD	Post Test Mean	SD	Gain Mean	SD
YouTube	46	28.39	11.92	57.65	14.39	29.26	20.89
Collaborative	38	22.21	8.11	43.68	10.98	21.47	15.12

Discussion	31	22.65	10.68	33.87	14.89	11.22	9.43

***Source*:** Field work, 2018

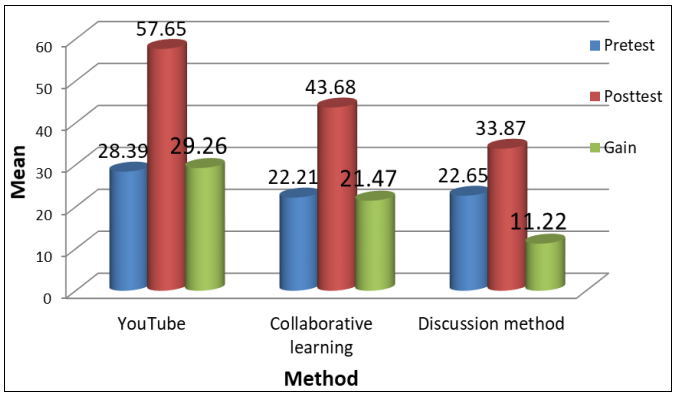

Fig 1: Mean scores of students based on mode of instruction

Table 1 showed that mean gain score by students taught using YouTube was 20.89, those taught using collaborative method was 15.12 while those taught using discussion method has 9.42.

Research Question 2

How does the performance of male students taught genetics using YouTube instruction differs from their male 0counterparts taught using discussion method?

Table 2: Performance mean and standard deviation scores of male students taught genetics using YouTube and their male counterparts taught using discussion method.

Model	Sex	N	Pre-test Mean	SD	Post Test Mean	SD	Gain Mean	SD
YouTube	Male	18	32.67	13.00	60.78	13.41	28.11	21.43
Discussion	Male	16	22.00	10.35	34.88	12.98	12.88	8.79

***Source*:** Field work (2018)

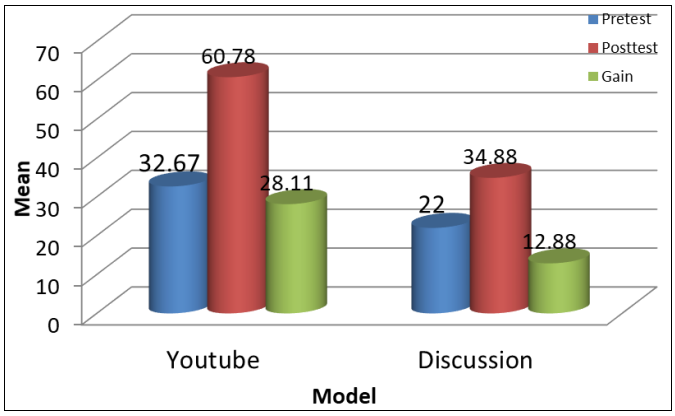

Fig 2: Mean scores of the male students taught using Youtube and Discussion modes

Table 2 shows that the mean gain of the male students taught using YouTube was 28.11 whereas the male students taught using discussion had a mean learning gain of 12.88.

Research Question 3

What is the mean difference in the performance of female students taught genetics using YouTube and their Female. Counterparts taught using discussion method?

Table 3: Mean difference in the performance scores of the female students taught genetics using YouTube and their female counterparts taught using discussion method.

Model	Sex	N	Pre-test Mean	SD	Post Test Mean	SD	Gain Mean	SD
YouTube	Female	28	25.64	10.51	55.64	14.87	30.00	20.91
Discussion	Female	15	23.33	11.33	32.80	17.08	9.47	10.07

***Source*:** Field work (2018)

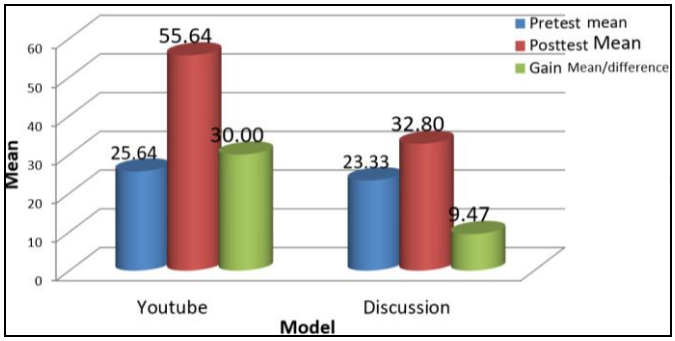

Fig 3: Mean scores of female students taught using Youtube and Discussion modes

Table 3 shows that the mean gain of the female students taught using YouTube was 30.00 whereas the mean gain of female students taught using discussion method was 9.47.

Hypothesis 1

There is no significant difference in the performance of students taught genetics with YouTube, collaborative and discussion instruction.

Table 4: Summary of ANCOVA on the difference between the performance mean score of the students taught genetics with discussion and those taught using YouTube and collaborative instruction

Source	Type III sum of squares	df	Mean square	F-test	Sig
Corrected model	11041.540	3	3680.513	20.080	.005
Intercept	32416.355	1	32416.355	178.857	.000
Pretest	76.747	1	76.747	.419	.519
Treatment	9876.476	2	4938.238	26.942	.000
Error	20345.382	111	283.292		
Total	281396.000	115			
Corrected total	31386.922	114			

Table 4 shows that there is significant difference between the performance mean score of the students taught genetics with discussion and those taught using YouTube and collaborative instruction ($p < 0.05$). Hence, null hypothesis one (HO_1) was rejected at 0.05 level of significance.

Hypothesis 2
There is no significant difference in the mean score of male students taught genetics using YouTube and their male counterparts taught using discussion method.

Table 5: Summary of ANCOVA on the difference between the performance mean score of male students taught genetics using YouTube and those taught discussion method

Source	Type III sum of squares	df	Mean square	F-test	Sig
Corrected model	5751.060	2	2875.530	16.157	0.000
Intercept	10073.807	1	10073.807	56.603	.000
Pretest	67.686	1	67.686	.380	.542
Treatment (male)	4215.685	1	4215.685	23.687	.000
Error	5517.175	31	177.973		
Total	91536.000	34			
Corrected total	11268.235	33			

Table 5 shows that there is significant difference between the performance mean score of male students taught genetics using YouTube instruction and those taught using discussion method, $p < .05$. The null hypothesis 2 was rejected at 0.05 alpha level.

Hypothesis 3
There is no significant difference between the performance scores of the female students taught genetics using YouTube and their female counterparts taught using discussion method.

Table 6: Summary of ANCOVA on the difference between the performance mean score of female students taught genetics using YouTube and their female counterparts taught using discussion method

Source	Type III sum of squares	df	Mean square	F-test	Sig
Corrected model	5233.290	2	2616.645	10.553	.000
Intercept	10639.006	1	10639.006	42.907	.000
Pretest	136.677	1	136.677	.551	.462
Treatment	4870.798	1	4870.798	19.644	.000
Error	9918.152	40	247.954		
Total	112884.000	43			
Corrected total	15151.442	42			

Table 6 shows that there is significant difference between the performance mean score of male students taught genetics using YouTube instruction and those taught using discussion method, $p <. 05$. The null hypothesis 3 was rejected at 0.05 alpha level.

Discussion
The study reveals that students taught genetics using YouTube and collaborative approaches performed better than those taught using discussion method (Table 1). This was consistent with the findings of Wang, Wu, Chen & Spector (2013) which opined that YouTube possess a great potential in the learning and teaching of science subjects. Table 2 revealed that male students taught using YouTube performed better than their male counterparts taught using discussion approach. The mean gain difference noticed could be attributed to the fact that YouTube method did not subject to the position of passivity due to the use of ICT. The female students taught using YouTube also performed better than their female counterparts taught using discussion method (Table 3).
Table 4, 5 and 6 rejects the hypothesis that there is no significant difference in the performance of students taught genetics using YouTube, collaborative instructions and their

discussion methods respectively as well as no gender difference with respect to the methods used in the teaching of the concept. This result is in consistent with the findings of Arokoyu & Nna (2012) which reported that the method of teaching a particular concept in science could enhance the performance of the students under investigation. However, the result is also consistent with the study carried out by Obomanu, Nwanekezi & Ekineh (2014) who opined that there is significant difference between the students taught ecology using collaborative method and their counterpart taught using discussion method. The study shows a significant difference between the performance scores of the students taught using YouTube and those taught using discussion and collaborative methods.

Conclusion

From the findings of this study, the following conclusion was made: Youtube and collaborative methods of teaching Genetics helped the students performance in the concept. Again, there was no significant difference between the achievement mean score of the student taught Genetics with discussion and those taught using Youtube and collaborative methods. Also, there was no significant difference between the achievement mean score of male students taught genetics using Youtube instruction and their counterparts taught using discussion method. However, there was significant difference between the achievement scores of the female students taught Genetics using Youtube and their female counterparts taught using discussion method.

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