

## IMPLICATIONS OF FLIPPED INSTRUCTIONAL STRATEGIES AND GENDER ON PRE-DEGREE STUDENTS' ATTITUDE TO BIOLOGY

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### Abstract

*The study examined the effects of flipped instructional strategies and gender on pre-degree students' attitude to Biology. Three null hypotheses were generated and tested at 0.05 level of significance. Pretest posttest control group quasi-experimental design was used; One hundred and seventy four pre-degree students purposively selected from three universities in Nigeria were involved in the study. Biology Achievement Test (BAT) and Students Attitude to Biology Questionnaire (SABQ) were the instruments used. Data were analysed using Analysis of covariance (ANCOVA). Result indicated that treatment was significant in enhancing student's attitude to Biology. There was no interaction effect of flipped instructional strategy and gender on students' attitude to Biology. It is therefore recommended that Biology lecturers should adopt flipped instructional strategies.*

**Keywords:** Flipped strategy, gender, attitude, pre-degree students

### Introduction

Biology is a vital Science subject in the Nigerian school system. It is generally defined as the study of life. Ukoh and Ade (2015) said that the introduction of science subjects in school curriculum (Biology inclusive) was done with a view to developing scientific attitude, scientific nature, critical thinking, active inquiry, independent work and understanding the physical world from different perspectives. Introductory courses in Biology often taken by Nigerian undergraduates in the Faculty of Science and Science Education programmes stand as gateways into science, introducing scientific inquiry, the use of evidence, and the core biological concepts that can help students make informed decisions about the complex Biology related problems in their daily lives. (Odili, 2006).

The conventional teacher-centred approach usually deployed for teaching Biology has been considered by researchers as one of the factors that have contributed to poor attitude of students

to Biology. For instance Danmole, (2012) said that whenever students are not involved in hands-on activities with equipment during practical sessions, they are likely to retain very little of what is being taught and this has implication on their attitude towards the subject. The poor attitude of students to Biology has also been traced to insufficient facilities/resources available for Biology instruction, especially the practical component of the subject, in many Nigerian Universities. This poor attitude to Biology may eventually translate into poor performance in it. Jegede and Ayeni (2013) commented that the use of practical approach such as field work in the instruction of Biology improves the attitude of teachers toward the teaching of biology.

Flipped instructional strategy also known as 'flip teaching', the 'inverted classroom', or 'reverse instruction' has been found to be particularly useful for lessons that are practical based which do not always have the materials needed readily available, and also with a large number of

students to cater for (Mike, 2012). Flipped learning is also suitable for courses such as Biology, which contents are voluminous and are usually difficult to complete during regular classroom periods, as well as for concepts that have more of practical work and that involve students' hands-on experience on equipment. In flipped instructional strategy, pedagogical model which largely depend on educational technology is used to leverage the learning in a classroom, so that a teacher can spend more time interacting with students instead of lecturing (Bergmann and Sams, 2012). The typical lecture and homework elements of a course are reversed or inverted.

The influence of gender on students' attitude to science courses has been vigorously examined by researchers. Divergent reports abound from fields of research on gender issue. Efuwape and Aremu (2013) concluded that there is no disparity in the use and acceptability of technology and science based equipment on gender. Studies have shown significant difference in favour of boys (Bilesanmi-Awoderu, 2002; Aremu and John, 2005; Abiona, 2008; Ojo, 2009): sometimes in favour of girls (Olatundun, 2008) and sometimes have shown no significant difference between boys and girls in relation to their achievement in and attitude to different science subjects (Owoyemi, 2007; Okoye, 2010). The findings of Ajitoni (2005) revealed that there were significant differences between female and male students in terms of attitude in favour of the female. Aremu and John (2005) in their study have stated that the search for strategies to bridge the gap in the achievement and attitude of males and females is an ongoing one. Olagunju (2007) reported that teachers, especially female teachers possessed significant attitude to the teaching of Biology. Her suggested reasons are perhaps high potential abilities in verbal expression and the ability to use technology.

There is the need to explore more effective strategies that will be learner- centered and activity based. This might be able to influence the attitude of students positively. The effect of a technology based strategy: flipped strategy, using animation and video packages on Nigeria State Universities pre-degree students' attitude to Biology was determined in this study. The flipped classroom model may provide many benefits for instruction that are not possible with the

conventional instruction. For example, after flipping his classroom, Bergmann (2011) said he could more easily query individual students, probe for misconceptions around scientific concepts, and clear up incorrect notions. By instinct, Bergmann said the most important benefit of flipped strategy is profoundly human and that he now had time to work individually with students and talk to every student in every classroom every day.

With flipped classroom approach there is now enough time for students to collaborate with peers, engage more deeply with contents, and receive immediate feedback from their instructor says Hamden, McKnight, McKnight, and Argstrom, (2013). One very important feature of the flipped class model is to increase teacher-to-student and student-to-student interaction during class time.

### **Statement of the Problem**

Despite the emerging trend in technology-assisted learning, researchers observed that the attitude of students to Biology is gradually becoming negative. This is evident in their low subscription or enrolment to the subject at senior secondary school level. Similarly, the result of students at Senior Secondary School level in Biology has been observed to be poor when compared with science subjects such as Chemistry, Agricultural science among others. This reflects the attitude of students to the course. Few scholars and agencies have also tried to get a solution to the problem of poor attitude to Biology courses by introducing electronic contents and making it available to the students on various electronic media, but this solution according to findings, appears to be more utilized by the male students than their female counterparts. These efforts therefore revealed that the use of Information and Communication Technology-based instruction such as the flipped strategy may not favour both male and female equally, which may be responsible for poor attitude by the female to the subject.

### **Hypotheses**

Three null hypotheses were raised to guide the study

1. There is no significant main effect of flipped instructional strategy on students' attitude to Biology

2. There is no significant main effect of gender on students' attitude to Biology
3. There is no significant interaction effect of flipped instructional strategy and gender on students' attitude to Biology

### **Methodology**

The study adopted the pretest-posttest control group quasi-experimental design. It determined the possible effect of animation and video-based flipped instructional strategies on pre-degree students' attitude to Biology in Southwestern Nigeria.

### **Instrument**

Two Instruments were used for the study. They are Biology Achievement Test (BAT) and Students Attitude to Biology Questionnaire (SABQ)

BAT is a thirty-five item multiple choice test items developed by the researchers. It was presented to experts in Biology Education for content and face validity. It was administered to 50 Biology pre-degree students (not part of the study sample) their scores were subjected to internal consistency using the Kuder- Richardson 20 formula. The values yielded 0.82 which shows that the instrument is reliable enough to be used for the study.

Similarly, SABQ is a twenty five item close-ended questionnaire developed by the researchers which sought the attitude of students to Biology. It was administered to 50 Biology pre-degree students (not part of the study sample) their scores were subjected to internal consistency using Cronbach alpha formula and it yielded 0.73 which shows that the instrument is reliable enough to be used for the study.

### **Selection of Participants**

Purposive sampling technique was used to select 174 pre-degree students (69 males, 105 females) from three state universities in Nigeria offering pre-degree programme. Criteria for selecting universities are the availability of hostel accommodation for students where electricity generators are always put on at night for students to read (for the experimental groups) as well as availability of pre-degree programme in Biology. Participants were also purposely selected based on their possession of a personal computer or other smart mobile devices that was used for flipping the lessons

Participants were assigned into Animation-based Flipped Strategy group (71), Video-based Flipped Strategy group (51) and control group (52). Treatment lasted eight weeks.

### **Results**

The results are presented according to the sequence of the hypotheses which were tested. Analysis of Covariance (ANCOVA) was computed for the variables in both the experimental and control groups. Estimated Marginal Mean (EMM) was also computed to find out how each of the groups performed, and where there is a significant difference among the groups. Scheffe Post-Hoc analysis was used to find out the source of significance among the three groups. All hypotheses were tested at  $p < 0.05$  level of significance

**Hypothesis One:** There is no significant main effect of flipped instructional strategy on students' attitude to Biology

**Table 1:** Analysis of Covariance (ANCOVA) of Post-Student Attitude to Biology Questionnaire Scores by Treatment and Gender

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Squared	Eta
Corrected Model	1473.486 <sup>a</sup>	18	81.860	1.244	.233	.126	
Intercept	9657.435	1	9657.435	146.740	.000	.486	
PreSABQ	2.962	1	2.962	.045	.832	.000	
Treatment	386.154	2	193.077	2.934	.041*	.036	
Gender	7.799	1	7.799	.119	.731	.001	
Treatment * Gender	24.695	2	12.348	.188	.829	.002	
Error	10201.043	155	65.813				
Total	771732.000	174					
Corrected Total	11674.529	173					

a. R Squared = .126 (Adjusted R Squared = .025) \* Denote significant difference at 0.05 level of significance

The results on Table 1 indicate that there is significant main effect of treatment on students' attitude scores ( $F_{(2,155)} = 2.934$ ;  $P < 0.05$ , partial  $\eta^2 = 0.036$ ). The effect size is 3.6%; this implies that 3.6% of the variance observed in the attitude mean score is due to the treatment. It means that there was a significant difference in the post-

attitude mean scores of students. Thus, hypothesis 1 was rejected. In order to determine the magnitude of the significant main effect across groups, the estimated marginal means of the groups was carried out and the result is presented in Table 2

**Table 2:** Estimated Marginal Mean Post-Attitude by Treatment and Control Groups

Treatment	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Flipped Animation (FAS)	68.02 <sup>a</sup>	1.784	64.493	71.540
Flipped Video (FVS)	66.08 <sup>a</sup>	1.904	62.322	69.845
Conventional Strategy (CS)	61.85 <sup>a</sup>	1.820	58.257	65.448

a=adjusted post-attitude mean score

Table 2 shows that students in the flipped animation strategy group had the highest adjusted post-attitude mean score (68.02) followed by the flipped video strategy group (66.08) while students in the conventional strategy control group had the least adjusted post-attitude mean score (61.85).

**Table 3:** Scheffe Post-hoc Analysis of Post-Attitude by Treatment and Control Group

Treatment	Mean	FAS	FVS	CS
FAS	68.02		*	*
FVS	66.08	*		*
CS	61.85	*	*	

\* = Pairs of significantly different at  $p < .05$  This order can be represented as  $FAS > FVS > CS$ .

Table 3 revealed that students exposed to flipped animation strategy are significantly different from their counterparts exposed to flipped video strategy and conventional strategy in their post-attitude scores. Furthermore, the students exposed to flipped video strategy are significantly different from those exposed to conventional strategy. This implies that both flipped animation and flipped video strategies are the main source of significant differences in treatment.

**Hypothesis Two:** There is no significant main effect of gender on students' attitude to Biology

The results in Table 1 shows that gender had no significant main effect on students' attitude to Biology ( $F_{(1,155)} = 0.119$ ;  $P > 0.05$ , partial  $\eta^2 = .001$ ). Hence the hypothesis was not rejected.

**Hypothesis Three:** There is no significant interaction effect of flipped instructional strategy and gender on students' attitude to Biology

The results in Table 1 revealed that there is no significant interaction effects of treatment and gender on students' attitude to Biology ( $F_{(2,155)} = .188$ ,  $P > .05$ , partial  $\eta^2 = 0.002$ ). Therefore, the hypothesis was not rejected.

## Discussions

Effect of Treatment on Students' Attitude to Biology

Findings from this study revealed that there is a significant main effect of animation and video-based flipped instructional strategies on students' attitude to Biology: students in the animation-based flipped group particularly had the highest adjusted post-attitude mean score, followed by the video-based flipped group, while students in the control group had the least adjusted post-attitude mean score. This result is in line with the findings of Adedoja *et al.* (2013), Aremu *et al.* (2013), Nsofor *et al.* (2015) and Adedoja (2016). Students are likely to have developed a positive attitude towards flipped classroom strategies because it frees them from the boredom often associated with the conventional method of teaching Biology. Observation from this study revealed that students' interest and participation in Biology have increased as a result of the flipped strategies used. Students in the treatment groups commented that they never knew that Biology

lectures could be this lively and benefiting. They specifically reported that they enjoyed the collaboration segments of the study. These reports are in conformity with what Jason (2012) experienced when he reported that 75% of students in flipped classroom frequently or always help other students in class.

It appears that any strategy that is ICT based always receives more attention and acceptance from students, especially those in higher level of studies. Several scholars have established this: Adedoja *et al.* (2010), Aremu *et al.* (2010), Efuwape *et al.* (2013), Akingbemisilu (2014), Aremu *et al.* (2015), Gladys *et al.* (2015). The rate of acceptance and usability of ICT based strategy by students in higher institutions has been confirmed high. It is therefore appropriate to infer that ICT based instructional strategy (such as flipped instructional strategy) always influence the attitude of students positively to the subject it is used to facilitate. In this study, the flipped strategy using animation and video platforms was able to significantly and positively influence the attitude of students towards Biology.

## Conclusion

The results of the study have shown that animation and video-based flipped instructional strategies are more effective in enhancing students' attitude to Biology than the conventional method. The flipped strategies produced more positive attitude to Biology than the conventional method. This means that the current low enrolment to Biology caused by poor attitude to Biology could be effectively tackled through the application of flipped instructional strategies.

## Recommendation

1. Lecturers taking Biology courses in universities should adopt flipped instructional strategy in teaching their courses
2. Curriculum planners and developers in Biology courses for Nigeria Colleges of Education and Faculties of Education and Science should emphasize on the need to continuously use innovative strategies such as flipped strategy to enhance biology instruction.

3. Educational technology and Biology units in various higher institutions of learning should incorporate flipped strategies into their curricula.

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