



Improving Students' Interest in Biology Using PowerPoint Presentation and Flipchart Teaching Strategies

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Abstract

Improving students' low interest in Biology prompted this study on effects of PowerPoint presentation and flipchart strategies on students' interest in Biology regardless of gender and school location. It has three research questions and four null hypotheses. Pretest-posttest non-equivalent control group design was used. Using simple random sampling and purposive sampling techniques, 144 SS II Biology students from four public co-educational secondary schools in Nsukka LGA served as sample. The instrument for data collection was a rating scale titled Biology Interest Scale (BIS) with a Cronbach Alpha reliability estimate of 0.86. Mean and standard deviation were utilized to answer the research questions, and Analysis of Covariance (ANCOVA) was employed to test the null hypotheses at a significance level of 0.05. The findings, among other things, showed that students who were taught Biology using a PowerPoint presentation scored more favourably on the interest scale than those who were taught using flipcharts strategy. It also revealed that when Biology is taught using PowerPoint presentation and flipchart teaching strategies, gender has no significant influence on students' interest in Biology, although school location does. The findings led to a conclusion, with recommendations among which is that Biology teachers should receive training through workshops, orientation courses, and seminars on how to use PowerPoint presentation and projectors to teach Biology concepts.

Keywords: PowerPoint presentation, curriculum, flipchart, interest, gender, school location

Introduction

The science of Biology as a field makes significant contributions to societal development. This is clear from the fact that it equips students to enroll in Biology related courses among which are Biotechnology, Pharmacy, as well as Agriculture, all of which allow them to contribute their quota to the advancement of the nation. The inclusion of Biology as a school subject guided by a curriculum was driven by its importance to the development of the nation and the individual. According to the Federal Ministry of Education (2009), the objectives of Biology instruction in secondary schools in Nigeria are to prepare students to acquire: adequate laboratory and field skills in Biology; meaningful and relevant biology knowledge; ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture; and reasonable and functional scientific attitude.

Additionally, to attain the forestasted objectives, the Biology curriculum's contents and contexts place strong emphases on field studies, guided exploration, laboratory procedures, and skills acquisition together with conceptual thinking. However, over time, students' performance in the

subject has been dismal. Based on the low performance of students in Biology, researchers like Igboabuchi (2010) and Olufunke (2012) noted that teaching Biology in secondary schools has not been satisfactory based on the poor performance of students in Biology. In 2015, out of the five South-East states in Nigeria that participated in the SSCE by WAEC, Enugu state took the last position with 51.91% in Biology (Ibe & Abamu, 2019). In 2016, out of the 10 group-A states in Nigeria to which Enugu state belongs, Enugu state took the 9th position in WAEC (Xmich, 2016). This poor performance of students was highlighted in the WAEC Chief Examiners Report, 2015–2017. Such a condition of poor performance in Biology is likely to affect students' interest. The high level of abstraction and invisibility of some biological phenomena and processes are to be blamed for students' low performance in Biology examinations (Agboghroma & Oyovwi, 2015; Etobro & Fabinu, 2017). Cimer (2012) asserts that the abstractness of the material contributes to a general lack of interest or boredom and is the main cause of students' poor academic performance.



Given the foregoing, it follows that teaching Biology content calls for the use of instructional strategies that will help students understand abstract biological concepts and increase their interest in learning about Biology. Etobro and Fabinu (2017) argued that to improve students' comprehension of Biology concepts, the Senior Secondary School Biology Curriculum must be updated, meaningful, and engaging for the students, which necessitates concept and process visualization. The authors maintained that a tool known as learning media, which would serve as a stimulus to the thoughts, feelings, concerns, and interests of students in clarifying the subject matter, was necessary for the learning process because students could occasionally misunderstand or fail to receive the messages conveyed by the teacher using the conventional teaching method. This is supported further by Richard Mayer's Cognitive Theory of Multimedia Learning (CTML) developed in 1988 (McGraw, 2019) which created a meaningful link between words and images. According to the theory, learners learn more effectively when given both words and pictures than when they only receive one of them. In support of this notion, this study investigates how learning media such as PowerPoint presentations and flipcharts teaching strategies affect students' interest in Biology.

PowerPoint presentations are educational tools created using the PowerPoint computer programme. PowerPoint has slides that let the user deliver messages. A Liquid Crystal Display (LCD) projector can better present information created on a computer for a bigger audience. By using a computer and projector to display slides to illustrate a lesson, a PowerPoint presentation can be used in the classroom to help students' learning (Hossein & Abdus, 2015). PowerPoint presentations may be more persuasive if they engage the audience's senses. This could enhance cognitive achievement and keep the audience's attention. The presentations that are instructive, engaging, and informative are the most effective ones (El-Ikhan, 2014). Studies that looked at how PowerPoint presentations affected students' learning results were successful (Ofili, 2016; Umar, 2011). However, the majority of these studies made dissimilar comparisons between PowerPoint presentations and more traditional teaching methods like lectures and demonstrations. Thus, a comparison with a closely related teaching strategy like flipchart is necessary.

The flipchart teaching strategy is a teaching strategy which makes use of charts. A chart is a visual

aid for explaining ideas or concepts that could be challenging to grasp when spoken words are used alone. Flipchart is one type of chart that is frequently utilized. Bello (2012) asserted that flipcharts present information in written or drawn components, which are then bundled into one. According to the author, employing flipcharts allows for the delivery of information in phases by sequentially inverting the images, with each image or message to be transmitted, being placed on a separate page of paper. Studies have been advanced on the effect of flipcharts on students' learning outcomes (Bello, 2012; Umar, 2015; Hardiyanti et al., 2018). It was discovered to enhance students' learning outcomes. Once more, those researchers contrasted the use of flipcharts and traditional teaching strategy. The studies so mentioned recommended the use of innovative teaching strategies in the teaching and learning process. Despite the advice to employ cutting-edge teaching strategies, some instructors still favour traditional teaching methods and/or strategies. This may be because such methods and/or strategies give the teacher's ego a boost by portraying them as authority figures and enabling them to cover the curriculum quickly. Teachers may not be able to halt the ongoing use of traditional teaching methods, but they can improve them by incorporating cutting-edge and activity-focused teaching strategies. In this sense, PowerPoint presentations and the use of flipcharts might be contrasted to see how effective each strategy might be for boosting students' interest in Biology that could improve poor or inconsistent performance in the subject area.

Interest is a term that is typically understood as a strong desire to learn new things. Interest in science is crucial because it spurs students to learn, and without it, it can be challenging for them to see the value of what they have learned. According to Yan (2011), students who are interested in a subject give close attention to it, observing carefully and actively thinking. Nwafor and Oka (2018) added that only by arousing students' interests can teachers enhance students' enthusiasm for learning Biology, help them master biological knowledge and techniques better, and form scientific spirits and attitudes. They further opined that Biology teachers need to focus on cultivating, stimulating, and sustaining students' interest in Biology. Unfortunately, according to Ali et al. (2014), Biology as a science subject is plagued by low students' interest and inconsistent performance in both internal and external examinations. Bae (2017)



stated that science teachers' ineffective use of teaching strategies and/or methods is to blame for the lack of interest among their students. Abdu-Raheem (2012) proposed that the availability of necessary materials and equipment that would make learning interesting and enjoyable be made available to students, and that instruction should then shift from a passive, teacher-centred classroom to an active student-centred one to ensure improved male and female students' interest in science subjects. Gender may influence a students' interest in Biology.

In general, the term "gender" refers to the culturally prescribed roles that men and women play in society. Men and women have various roles, rights, and obligations, as well as diverse relationships, depending on their gender (Bazilli, 2010). According to the author, gender refers to how people's characteristics, actions, and identities are formed through socialization rather than just referring to men or women. Oraifa (2010) distinguished between sex and gender, noting that sex is determined physically but gender is a social construction based on culture. However, Bello and Abimbola (2012) noted that sex role stereotypes have emerged and affect social, economic, political, as well as educational growth, particularly in the fields of science and technology, as a result of the significant interactions between gender and culture. For instance, Erinsho (2015) said that women's lack of interest in studying science is due to their perception that it is improper for them to pursue careers in science due to cultural male domination. This suggests that students' interest in studying science disciplines like Biology may be influenced by their gender. However, despite conflicting findings from various researches, gender concerns and their effects on students' learning outcomes in science disciplines have remained over time. For instance, Okorie and Ezeh (2016) stated that female students do better than male students in Biology, contrary to Taiwo and Emeke (2014) who found no statistical difference between male and female performance in the subject. Male students do better than female students in Biology, according to Musa et al. (2016) study. By examining the influence of gender on students' interest in Biology when taught using a PowerPoint presentation and a flipchart teaching strategies, this study would contribute to the debate about gender. Apart from gender, school location could influence students' interest in Biology when innovative teaching methods and/or strategies are used.

The location generally denotes a place where an object exists. Therefore, the term "school location" describes the specific position of a school to other sections of the physical environment (rural or urban). According to Joseph and Emmanuel (2017), compared to rural areas, urban areas are more favoured when it comes to the distribution of social amenities including pipe-borne water, electricity, healthcare facilities, educational facilities, and teachers. Due to the current circumstances, learning opportunities in Nigerian schools may vary depending on the location of the school. This is supported by Adebule and Aborisade (2013) who observed that rural areas suffer from a lack of social amenities including power, pipe-borne water, technical resources, as well as safe and secure facilities, all of which are necessary for the success of educational programmes. This suggests that an urban or rural school's location may influence how widely some innovative teaching strategies are adopted. This study therefore examined the effects of PowerPoint presentation and flipchart teaching strategies on students' interest in Biology, irrespective of gender and school location.

Research Questions

1. What is the effect of PowerPoint presentation and flipchart teaching strategies on students' interest in Biology?
2. What is the influence of gender on students' interest in Biology?
3. What is the influence of school location on students' interest in Biology?

Hypotheses

The following null hypotheses tested at a 0.05 level of significance guided the study.

- H₀₁** There is no significant difference between the mean interest scores of Biology students taught with the PowerPoint presentation strategy and those taught with the flipchart teaching strategy.
- H₀₂** There is no significant influence of gender on students' mean interest scores in Biology.
- H₀₃** There is no significant influence of school location on students' mean interest scores in Biology.
- H₀₄** There is no significant interaction effect of the two teaching strategies and gender on students' interest in Biology.

Method

The study adopted a quasi-experimental design of a pre-test, post-test non-equivalent group. Campbell and Stanley (1963) stated that quasi-experimental design aims at demonstrating a causal relationship between an intervention and an outcome, permitting the use of intact classes, pre-test, and post-tests of non-equivalent groups. Intact classes were used to ensure that the existing class structure and composition in the school is not disrupted. The study was carried out in Nsukka Local Government Area of Enugu State Nigeria. The population of the study comprised of 2,444 with 1,070 male and 1,374 female Biology students.

The sample of the study was 144 SS II Biology students drawn from four public co-educational secondary schools in the area. Multi-stage sampling techniques were used to draw the sample for the study. Firstly, the purposive sampling technique was used to sample only co-educational secondary schools from the 32 public secondary schools since gender is a variable in this study. Thereafter, two co-educational secondary schools were randomly drawn from the urban and rural schools respectively. One urban and one rural co-educational school were assigned to the experimental group while the remaining urban and rural schools were put in the control group. In each school, an intact class was used which comprised 33, 37, 42, and 32 students, making the sample size to be 144 students.

The instrument for data collection was a rating scale titled Biology Interest Scale (BIS) with 4-Likert response options of Strongly Agree (SA), Agree(A), Disagree(D) and Strongly Disagree (SD). The BIS was face validated by three experts, two from Science Education (Biology Unit), and one from the

Measurement and Evaluation Unit, of the Department of Science Education, University of Nigeria, Nsukka (UNN). The experts validated the instrument in terms of the clarity of items as well as the relevance of items to the study. The internal consistency reliability of BIS was determined using Cronbach Alpha after trial testing 20 copies of the instrument on 20 SS II Biology students in Igbo-Eze South Local Government Area that shared common characteristics with the study area in terms of having the same academic calendar and using the same Biology curriculum. It yielded a reliability value of 0.86 which was high showing that the BIS instrument is reliable.

Four research assistants who were the Biology teachers of the sampled schools were trained for six days on how to use the PowerPoint presentation (PPT) and flipchart teaching strategies. This helped to control extraneous variables such as the Hawthorne effect and teacher variables. Before the treatment commences, the research participants were given BIS by their regular Biology teachers to ascertain their pre-interest. The BIS was scored by the researchers. After the pre-test, the experiment commenced. Students in the experimental group were taught topics on nutrient cycles such as the carbon cycle, water cycle and nitrogen cycle among others using a PowerPoint presentation strategy while the control group was taught using the flipchart teaching strategy. After the treatment that lasted for two fortnights, the post-interest BIS was administered to the experimental and control groups. The post-interest was scored by the researchers and the students' scores were recorded. The researchers used mean and standard deviation to answer the research questions. Analysis of Covariance (ANCOVA) was used to test the null hypotheses formulated at a 0.05 level of significance.

Results

Table 1: Mean and Standard Deviation of Interest Scores of Students Taught Biology Using PowerPoint Presentation and Flipchart Teaching Strategies

Group	N	Pre-interest		Post-interest		Mean Gain
		Mean	SD	Mean	SD	
Experimental (PPT presentation)	70	5.24	3.22	11.95	3.62	6.71
Control (Flipchart)	74	5.37	3.11	9.48	4.07	4.11

Table 1 shows that students taught Biology using a PowerPoint presentation strategy had a mean pre-interest score of (M = 5.24, SD = 3.22) and a post-interest mean score of (M = 11.95, SD = 3.62). It has a

mean gain of 6.71. While the Biology students taught using the Flipchart strategy had a pre-interest mean score of (M = 5.37, SD = 3.11), and a post-interest mean score of (M = 9.48, SD = 4.07). It has a mean

gain of 4.11. Therefore, since the mean gain for PPT is higher, PowerPoint presentation had a superior effect than Flipchart's teaching strategy in improving

students' interest in Biology. This is further shown in Table 2 (Hypotheses table) below.

Table 2: Analyses of Covariance (ANCOVA) of Mean Interest of Students Taught Biology Using PowerPoint Presentation Strategy and Those Taught with Flipchart Teaching Strategy

Source	Type III Sum of Squares	df	Mean Square	F-cal	Sig.
Corrected Model	119.464	4	29.866	2.152	0.000
Intercept	2164.471	1	2164.471	155.953	0.000
Pretest	63.605	1	63.605	4.583	0.000
Treatment	17.832	1	17.832	1.285	0.000
Gender	20.048	1	20.048	1.242	0.114
School location	45.845	1	45.845	1.246	0.012
Treatment * Gender	35.514	1	35.514	2.559	0.201
Treatment * School location	23.469	1	23.469	1.256	0.134
School location * Gender	29.451	1	29.451	1.246	0.103
Error	1040.923	47	13.879		
Total	29173.0	52			
Corrected Total	1160.388	89			

Concerning H_{01} , Table 2 shows that the probability associated with the calculated value of F (1.285) for the effect of the PowerPoint presentation strategy and Flipchart teaching strategy on students' interest in Biology is 0.000. Since the probability value of 0.000 is less than 0.05 level of significance,

the H_{01} is not accepted. Thus, there is a significant difference between the mean interest scores of Biology students taught with the PowerPoint presentation strategy and those taught with the Flipchart teaching strategy.

Table 3: Mean and Standard Deviation of Interest Scores of Male and Female Students in Biology

Group	Gender	N	Post-Interest Mean	SD
Experimental (PPT presentation)	Male	31	11.98	3.75
	Female	39	11.92	3.56
Control (Flipchart)	Male	33	9.47	3.27
	Female	41	9.49	4.33
Total (Experimental and Control)	Male	64	10.73	3.51
	Female	80	10.71	3.95

Table 3 shows that the male students taught Biology using the PowerPoint presentation strategy had a post-interest mean score of (M = 11.98, SD = 3.75) while female students had a post-interest mean score of (M = 11.92, SD = 3.56). In addition, male students taught Biology using the Flipchart strategy had a post-interest mean score of (M = 9.47, SD = 3.27), while female students had a post-interest mean

score of (M = 9.49, SD = 4.33). The male students in Biology, had an overall post-interest mean score of (M = 10.73, SD = 3.51) while the female students had an overall post-interest mean score of (M = 10.7, SD = 3.95) in Biology. This means that male students showed more interest in Biology than female students when taught using the PowerPoint presentation



strategy. However, this was not significant as shown in the hypotheses in Table 2 above.

In H_{02} , the probability associated with the calculated value of F (1.242) for the influence of gender on students' interest in Biology is 0.114. Since

the probability value of 0.114 is more than 0.05 level of significance, the null hypothesis is accepted. Thus, there is no significant influence of gender on students' mean interest scores in Biology.

Table 4: Mean and standard deviation of interest scores of Rural and Urban students in Biology

Group	School location	N	Post-Interest	
			Mean	SD
Experimental (PPT presentation)	Rural	37	12.10	4.14
	Urban	33	11.80	3.52
Control (Flipchart)	Rural	32	9.50	3.10
	Urban	41	9.46	3.94
Total (Experimental and Control)	Rural	69	10.80	3.60
	Urban	74	10.63	3.73

Table 4 shows that in the experimental group, students in the rural area taught Biology using PowerPoint (PPT) presentation strategy had a post-interest mean score of ($M = 12.10$, $SD = 4.14$) while students in the urban area taught with PPT presentation had a post-interest mean score of ($M = 11.80$, $SD = 3.52$). In overall, the post-interest mean score of Biology students in the rural area is ($M = 10.80$, $SD = 3.60$) while the post-interest mean score of Biology students in the urban area is ($M = 10.63$, $SD = 3.73$). This shows that students in the rural area expressed more interest in Biology than students in the urban when taught using the PowerPoint presentation strategy. This was further substantiated by the hypotheses in Table 2 above.

As such, as regards H_{03} , the probability associated with the calculated value of F (1.246) for the influence of school location on students' interest in Biology is 0.012. Since the probability value of 0.012 is less than 0.05 level of significance, H_{03} is not accepted. Thus, there is a significant influence of school location on students' mean interest scores in Biology.

In null hypothesis 4 (H_{04}), the probability associated with the calculated value of F (2.559) for the interaction effect of the two teaching strategies and gender on students' interest in Biology is 0.201. Since the probability value of 0.201 is more than 0.05 level of significance, the null hypothesis is accepted. Thus, there is no significant interaction effect of the two teaching strategies and gender on students' interest in Biology.

Discussion

This study reveals that using PowerPoint presentations in teaching Biology concepts to students led to an increase in interest in the subject more than when the flipchart strategy is used. This is because, unlike flipchart which is limited to only text and drawings, the PowerPoint presentation incorporated other media like sound, images, animation and video that appealed to most human senses, thereby enhancing students' interest in Biology. This finding thus agrees with Karen (2014) who noted that PowerPoint Presentation engages multiple learning styles, increases visual impact, as well as provides annotations and highlights. The finding also agrees with Ofili (2016) that students taught with PowerPoint presentations have significant improvement in their learning outcome in Biology because it stimulates their interest in the subject and helps them to visualize abstract Biology concepts. The results also support the Richard Mayer's Cognitive Theory of Multimedia Learning (CTML) of 1988 that learners learn more effectively when given both words and pictures than when they only receive one of them. Using PowerPoint presentation stimulates multiple senses of the learners and sustains their interest during instructional process.

This study exposes that gender has no significant influence on students' interest in Biology. Although the male students had a slightly higher post-interest mean score than the female students in the experimental group as shown in Table 3, this difference was analysed to be insignificant as seen in Table 2. This could be as a result of PowerPoint



presentations being able to incorporate multimedia such as sound, animation and video that appeal to the senses of both male and female students. This finding agrees with Taiwo and Emeka (2014) though on achievement that there is no statistical difference between male and female students' performance in Biology. However, the finding disagrees with Okorie and Ezeh (2016) as well as Musa, Dauda, and Umar (2016) who though on achievement, reported statistical differences in the performances of male and female students in Biology.

This study shows that school location has a significant influence on students' interest in Biology when taught using a PowerPoint presentation and flipchart teaching strategies. The reasons for this higher interest in Biology by students in the rural area could be due to the novelty effect of being taught with such innovative teaching strategies that they may not have experienced unlike students in schools located in urban area who might have experienced the use of PowerPoint presentations. This finding thus agrees with Ezechi (2014) who stated that the location of a school determines to a large extent the level of students' performance in Biology.

This study reveals that there is no significant interaction effect of the two teaching strategies and gender on students' interest in Biology. This could be because both teaching strategies incorporated multimedia that appeals to both genders. This finding agrees with Ibe and Nwosu (2013) that teaching strategies had no significant interaction effect on the gender of the students. As such, PowerPoint presentation strategy is not gender biased.

Conclusion

Based on the findings of this study, it can be adduced that students taught Biology using PowerPoint presentation had significantly higher mean interest scores in Biology than students taught using the Flipchart teaching strategy; gender has no significant influence on students' interest in Biology when they are taught with PowerPoint presentation strategy; school location has a significant influence on students' interest in Biology when taught with PowerPoint presentation and there is no significant interaction effect of the two teaching strategies and gender on students' interest in Biology. As such, it can be concluded that PPT presentation is efficacious in enhancing students' interest in Biology irrespective of gender, although, school location has an influence on

students' interest in Biology when PPT presentation strategy is used.

Recommendations

The following recommendations are made:

1. Biology teachers should be trained through workshops, orientation courses and seminars on how to use PowerPoint presentations and projectors in teaching Biology concepts.
2. Government should provide computers, projectors and electricity in schools to enable teachers to implement a PowerPoint presentation strategy in Biology teaching.
3. Professional organizations like the National Association of Educational Media and Technology (NAEMT), Science Teachers Association of Nigeria (STAN) and all other stakeholders in Education should undertake the production of PowerPoint presentation packages for instructional use in schools.

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