Effects of Powerpoint Enhanced Instructional Strategy on the Academic Achievement of Biology Students in Yenagoa Metropolis

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ABSTRACT

The purpose of this research was to investigate the "effects of PowerPoint-enhanced instructional strategy on the academic achievement of biology students in Yenagoa region." The study used a pretest-posttest, control group quasi-experimental design. The population of the study included all SSII students in Yenagoa Metropolis, Bayelsa State. A sample of 87 pupils was chosen using the purposeful sampling technique. Two schools were randomly selected as the experimental and control groups, respectively, to be taught using the PowerPoint-augmented instructional technique and the lecture strategy. The research lasted five weeks. To drive the investigation, three research questions and three null hypotheses were raised and assessed at the 0.05 level of significance. The study's instruments comprise two instructional manuals, the "Mathematics Achievement Test (MAT)" and the "Basic Mathematical Ability Test". The MAT was comprised of 30 multiple-choice questions, and had a reliability index of 0.86 using Kuder-Richardson Formula 21 (KR-21), while the BMAT comprised of 25 multiple choice question, with a reliability of 0.82. The research questions were answered through mean and standard deviation, while t-test was used to test the hypotheses. The finding of this study showed there was no significant difference in the achievement of students taught with either strategy. The finding further showed that neither of the moderating variables (birth order or basic mathematical ability) had a significant effect on the students learning. It was recommended amongst others that other ways through which e-learning can be brought to the classroom be explored.

Keywords: *Effects, Powerpoint, Instructional Strategy, Academic Achievement, Biology Study*

Introduction

Biology is a popular and essential field of study. It is concerned with the study of life, and everything that portrays it. It deals with all variables related to every and any living organisms including their physical and chemical structure, function, evolution, life processes etc. (Umar et al., 2018; Abdulsalam et al., 2020). Biology also studies the existing interactions and relationships between living things and the non-living units of the world, and how they affect and might influence each other (Owolabi et al., 2019; Ramon & Bello, 2019). It is quite a broad field, as evident from its numerous sub-fields, which all influence the quality and understanding of life.

The biological field is quite essential to man and every other living organism, in the world. It a major factor that has contributed to the quality of man's life today, and is essential for

continued sustainability. The most prominent use of biology is the provision of relevant knowledge, which is needed to understand man and the other various life forms in our world today. This knowledge is needed and in applied in innumerable ways and fields, and its essential to maintain wellbeing and life's sustainability (Suwono et al., 2017; Fuller, 2021).

Biology is also rooted in the framework of various essential fields that affects life like fields of medicine, agriculture etc. (Annan et al., 2019; Joda, 2019). Biology is the basis for and an indispensable unit in the health sector, with all processes and workings in this sector dependent on knowledge provided through biological knowledge. Biology is the basis for various significant developments and advancements in this sector (Olutola et al., 2016). It is also significant in fields of drug and food production (Musa, 2020). It also plays major roles in the progress and expansion of a nation and its economy (Umoru & ONoja, 2017; Falemu et al., 2017).

Based on the importance of the subject, and it being a pre-requisite for further studies in several major science fields, a good performance of students in the subject is quite important and should be prioritized. Unfortunately, the major consensus from available data indicates a poor achievement rate in the subjects. This is easily observed from reports of students' achievement in external examinations in secondary school, where a credit pass in biology is needed to proceed for tertiary education in biology related domains. The data shows most students being unable to secure the needed credit pass in the subject (Adewale et al., 2016). This trend can be seen in the studies by Bichi et al., (2019), Adekunle and Femi-Adeoye (2016), Olutola et al., (2016) amongst others, who all explored how well the students achieved in the biology subject in conduct of WAEC examinations and reported a major decline in performance, with most of the students failing to get the desired credit pass in the subject, even though students cite biology as being one of the easier science subject to learn.

The poor achievement rate in the subject has birthed a lot of researchers and educators exploring the reasons behind it, and over time, a variety of variables and reasons has been cited as antecedents of students' poor achievement in biology. But though a myriad of factors affects students' performance, the variable of the style used in teaching the subject, has become quite prominent, with it being one of the most commonly cited reason for students' poor achievement rate (Olutola et al., (2016).

The lecture method is the traditional style or mode of instruction used in biology classrooms, and this has been identified as not being effective in ensuring meaningful learning outcomes. It is an approach to teaching that places the teacher at the helm of the whole instructional process, which is in direct contradiction to the principles of active learning, that is widely accepted as the modern framework for effective teaching. When lecturing, a teacher presents the learning content to the students in a face-to-face process in a physical classroom. The major downfall of this, the learners are expected to absorb learning data from the teacher passively, with little to no provision made for their involvement. Usually, the height of students' involvement in the lecture method classroom is in asking and answering a small number of questions at the end of a lesson (Olutola et al., (2016).

Over time, studies have been conducted to explore several approaches to enhance the outcomes of the learning process, but a current trend of instructional style innovation is the incorporation of computer technologies and Information Communication Technology (ICT) tools into the classroom instructional process, with this being regarded as holding major potentials for facilitating better learning process and outcomes.

The PowerPoint enhanced instructional strategy comes under the heading of an e-learning approach (instructional strategies involving the incorporation of computer and ICT tools into learning). As a strategy, it incorporates various features and resources made available in the PowerPoint application software, in supplementing and supporting the teaching and learning

processes. The PowerPoint software is developed by Microsoft as a part of their office package aimed at enhancing productivity in diverse workflows and processes. An application software as used in this context, refers to programs, which directs the computer in performing a specific task (Curly, 2021).

The PowerPoint productivity software, is geared towards the creation of short visual resources and data in the form of presentations (Osman et al., 2022). The presentations made in PowerPoint application consists of one of more different "slides", somehow similar to pages of Word documents. These slides are typically in landscape layout, and supports the inclusion of a myriad of visual and auditory elements. Slides in a PowerPoint presentation primarily contains texts and/or images, shapes, illustrations, charts, animations, diagrams, tables, sound and visual effects etc.

The PowerPoint application, supports a myriad of ways through which presentations can be presented or distributed to the intended audience including display through a computer projection on a wall or board (which is the primary/preferred mode of presentations), large television monitors, exportation to pdfs, and even in hard copy format (printed materials) etc. (Lowe, 2018). The PowerPoint user work interface is comprised of a variety of tools for editing and formatting, in order to design the final look of the presentations.

The PowerPoint can be used in facilitating the instructional process at the school environment by presenting learning content in a more visually pleasing way to the students amongst others. Ahmad et al, (2019) supports its use in carrying out teaching and learning, stating that the nature of available research indicates it is quite beneficial for the educational process and in ensuring better learning outcomes. The PowerPoint enhanced instructional strategy is associated with a variety of potential benefits including the presentation of the lesson content in a more meaningful, dynamic and effective manner to the students, decrease in time needed to present lesson content, increased attention and interest of students in learning, effective for handling complex content area, an excellent revision tool etc. Inoue-Smith (2016) state that among others, using PowerPoint in the instructional process is effective for the facilitation of greater precision in teaching, and the creation of deeper learning impressions for the students.

With an acknowledgement of the potentials of the PowerPoint enhanced instructional strategies in leading to better learning outcomes across all educational fields like biology, it is necessary to explore its practical utilizations in a classroom situation, which is the actual judge of just how effective the strategy is. Unfortunately, not much work has been done in this area in regards to the students' achievement in the biology subject, and this is the focus of this study.

Students' achievement in subjects like biology, can be further affected and influenced by a number of variables, which are present in the form of learners' characteristics, and outcomes of experiences. This variable might exist in the background, and not simply observed, they range from factors related to the nature of the learners' life to the outcomes of previous experiences in education and otherwise, which are part of the learners' cognitive structures. This study explores the moderating effects of two of these background variables; the birth order and the basic mathematical ability of the students.

Birth order can be said to be a property used to refer to the pattern or order of birth of children in a family, in a chronological order (Frederick-Jonah et al., 2020). Though the significance of this variable may not be obvious at first, it has been proven to affect the experiences of an individual across several major areas, including in the educational sector. Consequently, it is now the focus of many research endeavours with yet, no universally applicable conclusion or findings.

Al'Salaeh et al., (2021) states that the general findings on study related to birth order effects on academic achievement, indicates that the first-born students, have an advantage over those born later. Wamalawa and Burns (2017) contradicts the universality of that statement, stating

that the presence of first-born advantage in the educational sector is only prevalent in studies carried out in developed nations, and that the reverse is the case for developing countries, where the later-born are typically at an advantage.

Different conceptualisations, theories and explanations have been proposed over time in order to explain why there might be a first or later born advantage in education, but the vast number of this are heavily dependent on assumption, and cannot be described as concrete (Hiriscau & Pintea, 2022). This is especially due to the differing and complex dynamics across different families, with such differences usually making it that no explanation or model can be applied at every situation. The birth order variable might not only affect the achievement of students in general terms, but also how they respond to, and how effective, instructional techniques and experiences are for them. Based on potential effects of birth order in academics, this study seeks to explore how it might affect learning results of students in secondary school, in the context of PowerPoint enhanced instructional strategy.

Based on all of the above, this study thus explores the effect of PowerPoint enhanced instructional strategy, on the students' scores in biology, while considering the moderating effects of the birth order over the learning outcomes.

Aim and Objectives of the Study

The overall goal of this research is to probe the impact of a PowerPoint-enhanced teaching technique on students' scores/achievement in biology in secondary schools in Yenagoa, Bayelsa State. Specifically, the study sought to determine;

1. The mean scores of students of biology taught with PowerPoint enhanced teaching approach and those taught with the lecture approach.
2. The difference in mean scores of first and later-born students' scores in biology when taught with PowerPoint-enhanced teaching approach and those taught with lecture approach.

Research Questions

1. What are the mean scores of students in biology taught with PowerPoint-enhanced teaching approach and those taught lecture approach?
2. Is there a difference in the mean scores of first and later born students' achievement in biology taught with PowerPoint-enhanced teaching approach and those taught lecture approach?

Hypotheses

1. There is no statistically significant difference existing in the mean scores of students in biology taught with PowerPoint-enhanced teaching approach and those taught with lecture approach.
2. There is no statistically significant difference existing between the mean achievement of first and later born students' achievement in biology when taught with the PowerPoint enhanced instructional strategy and those taught with the lecture strategy.

Methodology

A pre and post-test control group quasi-experimental design was adopted. All senior secondary school 2 (SS2) biology students in Yenagoa Metropolis, Bayelsa State made up the study's population.

Using purposive selection procedures, two schools were chosen at random to be in the treatment and control groups. The following factors were taken into consideration when choosing the school:

1. The school must be government owned
2. Biology teachers at these schools must be professionally qualified, and must have been teaching biology for a minimum of four years.
3. The chosen schools' teachers must be open to and desirous of participating in the trial.

From each of the two schools, a single class was chosen at random to serve as both groups.
For the purpose of data collection, three instruments were developed and used in this study. These include; Instructional Guide on PowerPoint Enhanced Instructional Strategy (IGPEIS), Instructional Guide on the Lecture Instructional Strategy (IGLIS) and Biology Achievement Test (BAT). These are teaching guides that were prepared for the school teachers, by the researchers on the PowerPoint enhanced instructional strategy, and the lecture instructional strategy. These guides were used during the training/treatment period for groups respectively. The IGPEIS, IGLIS, and BAT, was subjected to face and content validity by expert review. As these instruments are biology based, they were validated by a qualified biology teacher in secondary schools, and a biology education specialist in Niger Delta University. Suggested corrections and improvements was considered and implemented when creating the final version of the instruments. The BAT and BMAT was administered to 35 students, not involved in the study, to determine the discriminating indices of the items. The obtained data was evaluated using the Kuder-Richardson Formula 21 (KR-21), yielding a reliability of 0.86 for the BAT.
The instrument was distributed in stages. The researcher first acquired an introduction letter from Niger Delta University's Department of Science Education, Wilberforce Island addressed to the selected schools' administrators or head teachers, requesting consent to use their school, staff, students, and resources for the study. Because the subject scope (topic) employed during the study might not be in sync with the students' existing scheme of work, it was critical to acquire the backing and collaboration of the head instructors and SSS II students that participated.
The researcher visited the participating teachers and students in their respective schools, in order to provide training and sensitization on how they can implement and adhere strictly to the tenets of the instructional and experimental procedures. Two teachers were trained as research assistants on how to utilize the IGPEIS (for the experimental group) and the IGLIS (for the control group). The first week was used for the training in the selected schools by the researcher.
The second week was used to administer the pre-test for the Biology Achievement Test (BAT) to the students by the teachers and researcher. The Basic Mathematical Ability Test (BMAT) was also administered at this stage, to enable the categorization of students' based on their level of mathematical ability.
Two weeks (the third and fourth week) was used for the administration of treatment to the experimental group using the IGPEIS, and the control group using the IGLIS.
Mean and standard deviation was used to answer the three research questions. While t-test statistical tool was used to analyse the three hypotheses.

Analysis and Results

Research Question One

What are the mean scores of students in biology taught with PowerPoint-enhanced teaching approach and those taught lecture approach?

Table 1: *Descriptive outcomes of research question one*

Treatment	No.	Pre-test Scores		Post-test Scores		Mean
		Mean	STD	Mean	STD	Gain
Lecture Strategy	42	35.36	9.89	55.34	7.09	19.98
PowerPoint Enhanced	45	31.52	10.16	57.94	7.25	26.42
Total	87	33.38	10.16	56.69	7.25	23.31

Source: Field work (2023)

The data in table 1 above shows that the descriptive results of students taught with PowerPoint enhanced approach (mean = 57.94, SD = 7.25) is greater than the score of students taught

through lecture strategy (mean = 55.34, SD = 7.09). The data further shows that the mean achievement scores of students taught with PowerPoint enhanced instructional approach (26.42) is greater than those in the control group (19.98). These results indicate that students in the experimental group outperformed those taught with lecture approach.

Research Question Two

Is there a significant difference in the mean scores of first and later born students' achievement in biology taught with PowerPoint-enhanced teaching approach and those taught lecture approach?

Table 2: *Descriptive outcomes of research question 2*

Treatment	Birth Order	No.	Pre-test Scores		Post-test Scores		Mean
			Mean	STD	Mean	STD	Gain
Lecture	**First-born**	21	34.25	10.59	53.91	7.11	19.66
Strategy	**Later-born**	21	36.47	9.27	56.77	6.94	20.3
	Total	42	35.36	9.89	55.34	7.09	19.98
PowerPoint	**First-born**	15	32.41	10.34	57.05	6.64	24.64
Enhanced	**Later-born**	30	31.08	10.21	58.39	7.61	27.31
	Total	45	31.52	10.16	57.94	7.25	26.42
Total	**First-born**	36	33.49	10.38	55.22	7.00	21.73
	Later-born	51	33.30	10.10	57.72	7.32	24.42
	Total	87	33.38	10.16	56.69	7.25	23.31

Source: Fieldwork (2023)

Table 2 above shows that the descriptive results of students taught lecture approach (mean = 56.77, SD = 6.94) is greater than the first born students (mean = 53.91, SD = 7.11). The same also goes for the students taught with PowerPoint enhanced instructional strategy where later-born students had a higher post-test mean score (mean = 58.39, SD = 7.61) than first born students (mean = 57.05, SD = 6.64). In total, the mean scores of later born students (mean = 57.72, SD = 7.32) is greater than their first born counterparts (mean = 55.22, SD = 7.00). It shows further that the mean achievement scores of later born students taught with approaches 24.42 > 21.73 of first-born students. This implies that later born students had a better achievement than first born students, for the two instructional strategies.

Test of Hypotheses

Hypotheses One

There is no statistically significant difference existing in the mean scores of students in biology taught with PowerPoint-enhanced teaching approach and those taught with lecture approach.

Table 3: *Inferential outcomes of hypothesis 1*

Treatment	No.	Mean	STD	df	t-value	Sig (p)	Decision
Lecture	42	55.34	7.09	85.00	-1.69	0.095	Not Significant
PowerPoint Enhanced	45	57.94	7.25				(p>0.05)

The data in Table 3 above shows that the difference in the achievement scores between students taught through lecture strategy and those taught through PowerPoint enhanced strategy is not significant (t = -1.69, df = 85, p > 0.05). Thus, the null hypothesis is accepted.

Hypotheses Two

There is no statistically significant difference existing between the mean achievement of first and later born students' achievement in biology when taught with the PowerPoint enhanced teaching approach and those taught with the lecture approach.

Table 4: *Inferential outcomes of hypothesis 2*

Birth Order	No.	Mean	STD	df	t-value	Sig (p)	Decision
First born	36	55.22	7.00	85	-1.60	0. 114	Not Significant (p>0.05)
Later born	51	57.72	7.32				

The data in Table 4 above shows no significant difference between the mean achievement of first and later born students in biology taught with both teaching approaches (t = -1.60, df = 85, p > 0.05). Thus, the null hypothesis is accepted.

Discussion of Findings

The findings of the study reported that students that taught with the PowerPoint enhanced instructional strategy had a better mean achievement than those taught through lecture strategy, the difference in mean achievement was not statistically significant.

The findings of this study coincide with that of Bichi, (2019) which explored how the use of PowerPoint based instructional strategy, affect the students' achievement in a microbiology course in comparison to traditional chalkboard-based lectures. The study reported that there exists no significant difference in the rate of achievement, though students taught with chalkboard-based lectures outperformed their counterparts, when it comes to learning complex materials. This result of this study contradicts that of Adebanjo (2020) and Adonu (2021) which explored the use of PowerPoint based instructional approaches, and its effect on the academic achievement in biology. Both studies reported the use of PowerPoint to have a significant positive impact on the achievement of student in biology.

This study found no significant difference existing in the mean achievement of first and later born students in biology when taught using the PowerPoint enhanced instructional strategy and those taught with the lecture strategy. This finding is in agreement with those of Reyes-Baybay (2018), McNally and Yuen (2015), and Albarkheel et al., (2019) which explored birth order effect on the academic achievement of students in varying contexts, and reported there exists no significant relationship between birth order and level of academic achievement.

This finding of this study contradicts those of Effiong and Igiri (2015), Sucgang and Fabella (2018), and Al'Saleh et al., (2021) which explored the possible effects of birth order on the academic achievement of students under varying contexts and conditions, and reported that a significant effect does exist.

Conclusion

PowerPoint enhanced instructional strategy is not better for biology learning than the lecture strategy. Thus, other e-learning approach or other applications of PowerPoint needs to be explored. Birth order difference does not influence students' biology achievement. Thus, no provisions need to be made to accommodate possible birth order effects, and all of the students can be subjected to the same attention and learning experience, despite their birth order.

Recommendations

Based on the findings of the study, the following recommendations are made;

1. Teachers and relevant educational bodies needs to explore other ways through which technologies like PowerPoints can be effectively incorporated into the biology teaching and learning process to as to reap the mass benefits.
2. Educational authorities and stakeholders, needs to make provision for the necessary support in terms of finances and resources, which will be needed to explore more innovative way to teach biology.

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