



## **Efficacy of Two Computer-Based Multimedia Lesson Delivery Approaches On Secondary School Students' Achievement in Biology in Federal Capital Territory, Abuja**

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### **Abstract**

The persistent reports on students' poor achievement in senior school certificate examinations in Biology call for serious academic search for better approaches to teaching secondary school biology to promote students' achievement. In view of this, the study investigated the efficacy of two computer-based multimedia lesson delivery approaches: Video Recorded Instruction (VRI) and PowerPoint Presentation (PPP) on secondary school students' achievement in Biology. Quasi-experimental research design specifically the pretest-posttest non-equivalent groups design was employed. The population comprised 28,841 secondary school year one (SS1) students in the 88 public secondary schools in FCT Abuja, Nigeria. A sample of 120 SS1 students offering Biology was drawn from four schools using purposive sampling technique. Data were collected using Biology Achievement Test (BAT) which was validated by three experts from Department of Science, University of Nigeria Nsukka. The internal consistency reliability of the items of the instrument was established using Kuder-Richardson formula 20 (K-R20) and yielded a reliability index of 0.79. The data were analyzed using Mean, standard deviation and ANCOVA tested at 0.05% level of significance. Findings of the study revealed among others, that students taught Biology using VRI achieved significantly higher than their counterparts taught using PPP. Based on the findings, it was recommended that Biology teachers should adopt VRI approach of the computer based multimedia lesson delivery in teaching secondary school biology to promote students' achievement in biology among others.

**Keywords:** Computer-Based Multimedia Lesson Delivery, Biology and Students' Achievement

### **Introduction**

The persistent reports on students' poor achievement in science subjects, including biology call for academic search for an approach to ameliorate the problem. Biology is a branch of science that deals with the study of life and the natural environment. It is an integral science subject that provides contents for students' careers in Medicine, Nursing, Pharmacy, and Psychology among. Biology is one of the science subjects that occupy a unique position in school curriculum and plays a vital role in developing individuals' abilities to apply scientific knowledge to every day's life (Sweller, 2021). The importance of biology is numerous. Biology touches every facet of human life as it is intrinsically involved in our day-to-day lives and plays a vital role in scientific advancement. For instance, without the knowledge of biology, epidemic disease caused by viruses and bacteria such as Lassa fever, Zika fever, Ebola, Bubonic plague and HIV/AIDS could have wiped out humankind. Regardless of the numerous importance of

biology to the scientific and human development, students' poor achievement in the subject has been persistent which reflected in the FCT statistical report on WAEC/NECO result analysis of 2019 – 2023 (Education Resource Centre (ERC), 2024).

Academic achievement is the level of success a student attains in the educational pursuits, typically measured by grades, test scores, completion of coursework, and other indicators of learning and mastery within an academic setting. It can also be referred to as the scholastic standing of a student at a given moment. According to Owoyemi (2019), academic achievement refers to how an individual is able to demonstrate or apply his/her intellectual abilities and accomplishment which is shown by score. Academic achievement encompasses not only the acquisition of knowledge but also the development of critical thinking skill, problem solving abilities and the application of learning in real world context (Oparah, 2020). However,



effective teaching and learning of biology can be evident in students' academic achievement. Ali (2018) noted that academic achievement portrays students' understanding of a educational concept and the ability of students to apply such knowledge to real life situation. Nevertheless, West African Examination Council (WAEC) biology chief examiners' reports (2019-2021) indicated students' poor achievement in biology and express specific worries about the effectiveness of instructional material and lesson delivery approaches used by biology teachers for delivering biology instructions.

Previous researchers have made efforts to identify and address students' underachievement in biology. For instance, Cimer (2018), Agboghroma & Oyovwi, 2018; Ahmed & Abimbola, 2019; and Etobro & Fabinu, 2021) attributed the under achievement to lack of interest due to students' perception of biology topics as boring, abstract and too difficult to understand. Some other researchers like Etukudo, (2016), Afolabi, (2017) reported that the fall in the level of achievement in biology can incontrovertibly be attributed to poor delivery approach adopted by the teacher in schools. Similarly, Salau (2019) stated that the students' poor achievement in public examinations is traceable to instructional delivery approaches adopted by the teacher in teaching secondary school biology. These studies therefore suggested for the introduction of a more innovative lesson delivery approaches to improve students' understanding of the subject. In view of these, Mayer (2019) suggested the introduction of an innovative teaching approach that could be used to improve students' academic achievement in Biology. In the same vein, Azuka (2020) suggested the adoption of an effective lesson delivery approach in the teaching and learning of science subjects including biology which could be vital to the enhancement of students' achievement in the subject.

The task before any good teacher is to help students improve on their abilities to assimilate information. Biology concepts cannot be learned effectively through rote learning rather through approaches and methods and allow students to have mastery of concepts. Purchy and Luepruti (2018) asserted that learning becomes more effective when experiences are passed across to the learner through an appropriate instructional method.

The above worries prompted the researchers to investigate on the Efficacy of two computer based multimedia lesson delivery approaches on secondary school students' achievement in biology. The lesson delivery approaches investigated is the Computer Based Multimedia (CBM) specifically: Video Recorded Instruction (VRI) and Power Point Presentation (PPP).

Computer Based Multimedia (CBM) refers to the integration of various media elements such as text, graphics, audio, video, animation and interactive elements within a computer system or application. CBM lesson delivery approach simply means the use of sophisticated digital materials to support teaching and learning. Mayer (2018) define CBM lesson delivery approach as an approach which allows for creation, manipulation, storage and presentation of information in multiple formats using digital technology. CBM delivery approach can be used to enhance learning experiences by providing dynamic and interactive content that engages learners and accommodates different learning style (Quinn, 2017). According to UNESCO (2018), Computer Based Multimedia (CBM) lesson delivery approach is a powerful tool that assists teachers to enhance their professional capacity and helps students to achieve their educational goals. Effective teaching and learning can be achieved with the use of various techniques and innovations of digital resources such as CBM. This is because CBM as stated by (Vaughan, 2018) enables teachers to deliver instructional materials in more engaging and effective ways, incorporating visuals, audio and interactive exercises to reinforce concept and facilitate understanding.

The importance of (CBM) is enormous. CBM supports teaching and learning through the audio-visual (hearing, seeing, feeling and doing) which is concerted in educational technology. It allows information to be easily transferred from one location to another as well as aid presentation of text, pictures, audio and video with links and tools that allow the user to navigate, engage, create and communicate using a computer screen. It also permits integration of text, drawings, still and moving images, recorded videos, graphics, power-point and any other media in which any type of information can be expressed, stored, communicated and processed digitally.

The 21<sup>st</sup> century teachers primarily



require digital resources in the teaching and learning that is in line with the technological advancement of this era to communicate and help students to understand educational concept particularly sciences. Teachers as facilitators of learning will consciously determine the digital pedagogy and strategies which are in line with the educational objectives and select the appropriate pedagogical approach that will best suit a given lesson topic (Hussaina, 2019). Verma (2017) noted that CBM lesson delivery approaches are essential tool for teaching and learning particularly in this era of technological advancement where learners are exposed to different distractive digital applications that may captivate learners' attention and interest. It therefore becomes imperative for biology teachers to identify digital pedagogies which can promote learners' active participation, capture their attention, interest and promote understanding and thus prepare their lessons alongside (Dabbagh & Kitsantas, 2017).

There are many modes of CBM lesson delivery approaches which include: Virtual Reality Simulations (VRS), Audio Tape Instruction (ATI), Video Recorded Instruction (VRI) and Power-Point Presentation among others. Virtual Reality Simulation (VRS) is a CBM lesson delivery approach which models a real life or imaginary situation in order to give the learners the ability to visualize a process. Audio Tape Instruction (ATI) is a CBM format in which instructions are delivered through spoken words, allowing the learners to listen and absorb the content without relying on written text. The Video Recorded Instruction (VRI) is a form of CBM lesson delivery approach that conveys information through two simultaneous sensory channels (aural and visual). It often uses multiple presentation modes such as verbal and pictorial representation (Mayer, 2018) while the Power Point Presentation (PPP) is a virtual medium that allows the users to manipulate text, pictures, models, and other graphical elements with great creative flexibility. These CBM lesson delivery approaches can be used to enhance teaching and learning if rightly chosen for a given lesson topic.

The two CBM lesson delivery approaches that were investigated in this study are; Video Recorded Instruction (VRI) and PowerPoint Presentation (PPP). The choice of these two approaches out of the other CBM lesson delivery approaches was because both

have special features which differentiate them from other approaches and from each other and thus can be studied to determine their differential effects on students' achievement. One notable difference is that VRI portrays a continuous stream of audio and visual content often featuring an instructor delivering a lesson while PPP consist of a series of slides containing text, images, and multimedia elements often accompanied by spoken narration. Based on these differential effects, this study investigated the efficacy of VRI and PPP on secondary school students' achievement in Biology.

### Statement of the Problem

The persistent reports of students' underachievement in secondary school biology over the years, call for further academic search for digital pedagogical approaches that could promote students' achievement in biology. Although several researchers have made effort to improve students' achievements in the subject by suggesting different innovative teaching approaches that could be in lesson delivery to boost students understanding of the subject but it is still disheartening to note that students' achievement in the subject has remained below the average. What then could be the possible reason and solution to this problem? Could it be as a result of the inability of biology teachers to select the appropriate technology infused approach of the technological era that could be used to capture biology students' attention and interest to promote achievement or that the abstractness of some topics that require real life simulations and likes.

The above worries have motivated the researchers to explore possible digital pedagogical approach such as CMB lesson delivery approach that could be used to promote students' achievement in biology. Hence, the problem of this study put in question form therefore is: what is the efficacy of CMB lesson delivery approaches (VRI and PPP) on secondary school biology students' achievement in Federal Capital Territory (FCT) Abuja, Nigeria

### Research Question

The study was guided by research question.

1. What are the mean achievement scores of secondary school students taught



biology using VRI and those taught using PPP?

### Hypothesis

The hypothesis was tested at 0.05% level of significance.

**H<sub>01</sub>:** There is no significant difference in the mean achievement scores of students taught biology using VRI and those taught using PPP.

### Method

The study adopted a quasi-experimental research design specifically the Pretest-Posttest non- equivalent group design. Nworgu, (2018) defined quasi- experimental design as an experiment where random assignment of subjects to experimental and control groups is not possible. In this case, intact classes were used. The population comprised 28,841 secondary school year one (SS1) students in the 88 public secondary schools in FCT Abuja, Nigeria. A sample of 120 SS1 biology students of the population was drawn from four different schools with functioning computer facilities through purposive sampling technique out of which

four intact classes of 30 students each were selected using simple random sampling procedure. Two intact were assigned to VRI and PPP respectively using simple random sampling also. Data were collection using Biology Achievement Test (BAT) developed by the researcher and validated by three experts from Department of Science, University of Nigeria Nsukka. The internal consistency of the instrument was established using Pearson's Product Monument Correlation (PPPC) and yielded a reliability index of 0.79. The data were analyzed using Mean standard deviation and the hypothesis analyzed using ANCOVA tested at 0.05% level of significance. Findings of the study revealed among others, that students' taught biology using VRI achieved significantly higher than their counter part taught biology using PPP. Based on the findings, it was recommended that biology teachers should adopt VRI approach of the computer-based multimedia lesson delivery in teaching secondary school biology to promote students' achievement in biology among others.

### Result

**Research Question 1:** What are the mean achievement scores of secondary school students taught biology using Video Recorded Instruction and those taught using PowerPoint Presentation?

**Table 1:**  
*Mean and standard deviation of the methods on achievement in secondary school Biology*

Methods	n	Pretest		Posttest		Mean Gain
		Mean	SD	Mean	SD	
VRI	60	20.02	2.752	30.40	3.253	10.38
PPP	60	21.58	3.792	25.78	2.841	4.20

**NB: VRI= Video Recorded Instruction; PPP= PowerPoint Presentation; SD= Standard Deviation**

Table 1 show the mean and standard deviation of students taught biology using Video Recorded Instruction (VRI) and those taught using PowerPoint Presentation (PPP) on their achievement in secondary school Biology. The analysis reveals that students taught biology using VRI had pretest mean achievement scores of 20.02 with standard deviation of 2.752 and a post-test mean achievement scores of 30.40 with a standard deviation of 3.253 while those taught using PPP had pretest achievement scores of 21.58 with a standard deviation of 3.792 and a post-test mean

achievement score of 25.78 with a standard deviation of 4.20. The mean gain scores of 10.93 and 4.20 respectively for students' biology using VRI and PPP indicates that students taught biology using VRI achieved higher than their PPP counterparts. The posttest mean achievement scores of students taught biology using VRI and PPP were greater than their respective pretest achievement scores with those taught with VRI method having a higher mean gain. Besides, further analysis on confirming whether the differences in the mean achievement scores of students taught biology





using VRI and PPP is statistically significant or not, the researcher tested hypothesis one at 0.05

level of significance.

**Hypothesis:** There is no significant difference in the mean achievement scores of students taught biology using VRI and those taught using PPP.

**Table 2:**  
*Analysis of covariance of the effect of VRI and those taught using PPP on students' mean achievement scores in Biology*

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2354.128 <sup>a</sup>	2	1177.064	141.412	.000	.707
Intercept	1120.842	1	1120.842	134.658	.000	.535
Pre-Achievement	126.719	1	126.719	15.224	.000	.115
Methods	2354.128	1	2354.128	282.825	.000	.707
Error	973.864	117	8.324			
Total	85021.000	120				
Corrected Total	3327.992	119				

a. R Squared = .707 (Adjusted R Squared = .702)

Analysis in Table 2 shows ANCOVA of the effect of VRI and PPP on students' achievement scores in Biology. The result shows that an F-ratio of ( $F(1, 119) = 282.825$ ,  $p < .05$ ,  $\eta_p^2 = .707$ ) was obtained. Since the associated probability value of 0.000 is less than 0.05 set as level of significance, the null hypothesis was rejected. Thus, inference drawn is that there was a significant difference in the mean achievement scores of students taught biology using VRI and those taught using PPP. This shows that teaching biology using VRI method proved to enhance students' academic achievement more. The result further showed the effect size of ( $\eta_p^2 = .707$ ), which indicates that the effect VRI and PPP teaching methods had on students' achievement in biology is .707. Thus, this implies that 70.7 percent variance in students' achievement in biology can be explained by the instructional methods used.

## Discussion

The finding of the study shows that students<sup>2</sup> taught Biology using VRI achieved higher than their PPP counterparts. This means that students who learned biology through VRI

achieved more in the subject compared to students who were taught using PPP approach. Hence, students' achievement in biology was improved with the use of VRI lesson delivery approach. This could be due to the fact that VRI yield to two senses (sight and audio) which must have influenced different learning styles of students to promote achievement. The annotations (text or graphics that appear on the screen, provides additional information, highlight key points and also offer explanations) which provide real-life examples making the learning experience more dynamic and relatable. However, the significant difference in the mean achievement scores of students taught biology using VRI and those taught using PPP further revealed a noticeable statistical difference and the efficacy of the VRI over PPP.

The above finding agrees with the finding of some previous studies of Chinna and Dada (2019), Agummuoh and Nzewi, (2021) who reported a significant improvement on students' achievement due to exposure to videotape instruction over Power Point Presentation. On the contrary, the finding disagrees with the findings of Rotimi, Ajogbeje



and Akeju, (2017) and Polk (2019) who reported no significant difference in the achievement levels of the students using Animated Instruction lesson delivery and Power Point Presentation.

## Conclusion

Based on the finding of the study the following conclusion was made; students' taught biology using VRI had a higher achievement score more than their PPP counterparts. Although the two modes promoted students' achievement in biology, further analysis showed that there was a significant difference in the mean achievement score of students taught biology using VRI over those taught using PPP.

## Recommendations

In view of the finding the researchers recommend that:

1. Biology teachers should adoption the CBM lesson delivery in biology teaching and learning particularly the VRI that had a significant improvement on students' achievement in biology.
2. Curriculum planners should revolutionize and enshrine the use of CBM lesson delivery approach particularly the VRI in lesson delivery into the content of instructional program during curriculum planning and ensure its implementation.

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