



**Effectiveness of Multimedia Teaching Devices on Students' Performance in Circulatory  
Concept in Port Harcourt.**

**Eseroghene Avwiri**

[eseroghene.avwiri@uniport.edu.ng](mailto:eseroghene.avwiri@uniport.edu.ng)  
<https://orcid.org/0009-0004-4556-1060>

**Science Education Department  
Faculty of Education  
University of Port Harcourt, Port Harcourt, Nigeria**

**&**

**Dorathy Okokon Ekong**

**Curriculum Studies and Educational Technology  
Faculty of Education  
University of Port Harcourt, Port Harcourt, Nigeria**



**Abstract**

This study investigated the effect of multimedia teaching devices on Biology students' academic performance of the concept of the circulatory system. 3 objectives, 3 research questions, and 3 null hypotheses were formulated to give direction to the study. The study adopted a quasi-experimental research design, and a non-randomized pre-test, post-test design was used. The population of the study consisted of all the 5,090 SSII students in the Seventeen (17) Public Secondary Schools in Port Harcourt Local Government Area of Rivers State. The study sample comprised 150 of the SS II Students selected using a purposive sampling technique. The validated instruments for the study were titled Biology Performance Test, with a reliability of 0.87, determined using the Kuder-Richardson formula 21. Data obtained from all the tests were analysed using mean, standard deviation, and Analysis of Covariance (ANCOVA). The result showed that there was a significant difference in the mean performance scores of Biology students taught the concept of the circulatory system using audio-video-based multimedia instructional devices, those taught using graphics-based multimedia instructional devices, and those taught using the lecture method. It was also revealed that there is no significant difference in the mean performance scores of male and female Biology students. Also, there was no significant interactive effect of the use of audio-video-based, graphic-based multimedia instructional devices, the lecture method, and gender on Biology students' performance scores when taught the concept of the circulatory system. Recommendations were made, among others, that Biology teachers should make effective use of audio-video-based multimedia devices in teaching concepts in Biology, and there should be no gender disparity.

**Keywords:** Multimedia teaching devices, Students' Performance, Biology



## **Introduction**

Biology is one of the core science subjects in the Nigerian secondary school curriculum and a branch of science that provides students with adequate and relevant skills for problem-solving, critical thinking, communication, and objective reasoning, all of which are 21st-century skills that will make them relevant in the future place of work (Oghenevwede, 2019). The main objective of Biology Education in Nigeria is to enable the Nigerian child to observe and explore the environment and develop basic skills in Biology that will help the child understand simple natural phenomena and develop appropriate scientific attitudes, which include curiosity, critical reflection, and objectivity.

The concept of audio-visual multimedia teaching devices encompasses various digital tools and information technologies that integrate different forms of media such as text, audio, video, and interactive elements, to enhance the teaching and learning process. It also engages students actively, accommodates diverse learning styles, and helps facilitate a deeper understanding of content. Multimedia teaching tools facilitate a richer learning experience by presenting information in various formats, catering to auditory, visual, and kinesthetic learners (Mayer, 2016). However, it will assist in improving students' performance.

The academic performance of secondary school students in Biology is a critical concern, as it not only impacts their overall educational outcomes but also influences their future career choices in science-related fields. On performance and strategy, Osemwinyen (2018) reported that students taught Biology using e-learning (audio-video aids) performed better than those taught the same topic using the conventional lecture method. Babasola (2015) also reported that the achievement scores of students taught with Video and Audio Aided Instruction were higher than their counterparts taught with the conventional lecture method. Akara and Avwiri, (2025) worked on the effect of instructional strategy on Physics students' academic performance in secondary schools in Rivers State and found that the flex instructional strategy had a significant effect on the mean performance of students in Physics. Again, Akinbadewa (2020) carried a study on the impact of computer-based multimedia education packages on the academic performance of Biology students in senior secondary school in Ibadan, Oyo State, Nigeria, the finding from the study shows a significant impact of strategy on students' achievement in Biology which implies that Multimedia educational packages greatly improved students acquisition of Biology concept better than the conventional technique.



In the study on gender, multimedia devices and students' academic performance carried out by Akpan (2015), reported that there were no statistically significant differences between girls and boys in their ability to manipulate the apparatus, take observations, report results correctly, interpret, and analyse results during Physics practical. Adigun, et al (2015) reported that even though the male students had slightly better performance and retention compared to the female students, it was not significant. Obafemi (2015) carried out a work on bridging the gender gap in Physics classroom: the instructional method perspective in Ikwerre Local Government Area of Rivers State, where the students were taught light waves. The findings were able to show that there is a significant difference between the male and female students, with the male students showing the highest performance.

On the interactive effect of multimedia devices and gender on students' performance, Macaulay and Obafemi,(2022) investigated gender and instructional strategy as predictors of students' performance in electrolysis in Obio-Akpor Area of Rivers State. And discovered no significant difference in the joint interaction between gender and strategy on performance. Moreover, Avwiri and Uwadieke (2026) carried out a study on the effect of meta-conceptual and scaffolding instruction on senior secondary students' Physics achievement. The finding revealed that there was no significant joint effect of teaching strategy and gender on students' performance in Physics.

### **Statement of the Problem**

The academic performance of students in Biology is a crucial factor in determining their success in the subject and their future career prospects. Therefore, it is important to explore the potential effect of multimedia teaching devices on enhancing students' academic performance in Biology. The use of multimedia teaching devices in education has gained significant attention in recent years due to its potential to enhance students' learning experiences. According to the WAEC Chief Examiners' Report 2009 and 2015, the major weaknesses and difficulties come in the areas of the Circulatory System Concept. The reason for these difficulties may be either that the students lack the framework to deepen their understanding of the concepts or that the use of ineffective teaching methods is being used in teaching the concepts. Could the use of multimedia improve students' performance in the circulatory system? Therefore, there is a need to explore a change in teaching strategy. This study, therefore, aims to investigate the effect of the use of multimedia teaching devices on students' academic performance in Biology in Port Harcourt Local Government Area, Rivers State.



### **Aim and objectives of the Study**

The study aims to determine the effect of multimedia instructional devices on Biology students' academic performance of the concept of the circulatory system. Specifically, the study sought to:-

1. Determine the difference in the mean performance score of Biology students taught the concept of the Circulatory System using audio-video-based, graphics-based multimedia instructional devices and those taught using the lecture method.
2. Ascertain the difference in the mean performance scores of male and female Biology students taught the concept of the circulatory system using audio-video-based multimedia instructional devices and those taught using the lecture method.
3. Ascertain the interactive effect of the use of audio-video-based, graphic-based multimedia instructional packages and gender on Biology students' performance scores when taught the concept of the circulatory system.



### **Research Questions**

The following research questions were raised to guide the study.

1. What is the difference in the mean performance scores of Biology students taught the concept of the circulatory system using audio-video-based multimedia instructional devices, those taught using graphics-based multimedia instructional devices, and those taught using the lecture method?
2. What differences exist in the mean performance scores of male and female Biology students taught the concept of the circulatory system using audio-video-based, those taught using graphics-based multimedia instructional devices, and those taught using the lecture method?
3. What is the interactive effect of the use of audio-video-based, graphic-based multimedia instructional devices and gender on Biology students' performance scores when taught the concept of the circulatory system?

### **Hypotheses**

The following null hypotheses were formulated for this study:

1. There is no significant difference in the mean performance scores of Biology students taught the concept of the circulatory system using audio-video-based multimedia



instructional devices, those taught using graphics-based multimedia instructional devices, and those taught using the lecture method.

2. There is no significant difference in the mean performance scores of male and female Biology students taught the concept of the circulatory system using audio-video, graphics-based multimedia instructional devices, and those taught using the lecture method.
3. There is no significant interactive effect of the use of audio-video-based, graphic-based multimedia instructional devices and gender on Biology students' performance scores when taught the concept of the circulatory system.

### Methodology

Quasi- experimental between groups' research design involving pretest and posttest was adopted for this study. The independent variable is instructional strategy, the dependent variable is students' performance in the concept of the circulatory system, while the moderating variable is gender. The study area is the Port Harcourt Local Government Area of Rivers State. The purposive sampling technique was used to select 3 schools. A sample of 150 Biology senior secondary school students was selected from a population of 5090. Audio-Video Based and Graphic-based multimedia instructional devices were the experimental group, while the Lecture method was the control group. The validated, researcher- constructed instruments were used to collect data, Biology Performance, with a coefficient of 0.87 obtained using the Kuder-Richardson formula method (K-R 21). The Biology Performance Test was administered to each group before and after the strategy was used to teach the students. It contained 50 multiple-choice questions with three distractors and one correct option lettered A-D. Each correct answer scored two (2) points, and a wrong answer was scored zero, giving a total of 100%. Means ( $\bar{x}$ ) and standard deviations ( $s$ ) were used to answer the research questions, while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 alpha levels.

### Results

**Research Question 1:** What is the difference in the mean performance scores of Biology students taught the concept of the circulatory system using audio-video-based multimedia instructional devices, those taught using graphics-based multimedia instructional devices, and those taught using the lecture method?



**Table 1: Mean and standard deviation of students' pre-test and post-test scores classified by treatment groups**

Treatment Groups	N	Pre-test		Post-test		Mean Score	Gain
		$\bar{x}$	SD	$\bar{x}$	SD		
Audio-video	52	24.42	7.65	69.62	6.09	45.20	
Graphics	50	22.70	7.84	60.00	5.62	37.30	
Lecture method	48	23.44	7.80	34.79	6.18	11.35	

Table 1 shows that the main gain scores and standard deviation of students taught using audio-video based, 45.20 and 6.09 (Mg =45.20 and SD= 6.09), the main gain and standard deviation of students taught graphics is 37.30 and 5.62 (Mg =37.30 and SD= 5.62) while the main gain scores and standard deviation of students taught using Lecture method is 11.35 and 6.18 (Mg =11.35 and SD =6.18) respectively. This indicates that, though students taught using audio-video-based multimedia strategy had the highest mean performance scores and the widest scattering of raw scores about the group mean, those taught using the lecture method had the lowest score, with their raw scores closest to the group mean. This shows that students performed better when taught with an audio-video-based strategy.

**Research Question 2:** What differences exist in the mean performance scores of male and female Biology students taught the concept of the circulatory system using audio-video-based, those taught using graphics-based multimedia instructional devices, and those taught using the lecture method?

**Table 2: Mean and standard deviation of students' pre-test and post-test scores classified by treatment groups and gender**

Treatment Groups	Gender	N	Pre-test		Post-test		Mean Score	Gain
			$\bar{x}$	SD	$\bar{x}$	SD		
Audio-video	Male	22	31.41	12.72	69.55	6.53	38.14	
	Female	30	30.32	8.94	69.67	5.86	39.35	
Graphics	Male	23	32.21	10.01	60.22	5.53	28.01	
	Female	27	37.44	11.04	59.81	5.80	22.37	
Lecture method	Male	30	23.48	8.72	35.33	6.01	11.85	
	Female	18	27.93	8.47	33.89	6.54	5.96	

The mean scores difference by gender displayed in Table 2 shows that the female students in the audio-video group had the best mean gain score (Mg=39.35), followed by their male counterparts in the same group (Mg = 38.14). Furthermore, those in the graphics group



followed the audio-video group with mean gain scores of ( $Mg = 28.01$ ) and ( $Mg = 22.37$ ), for the male and female students, respectively. However, the male and female students in the lecture method group had the least post-test, pre-test mean scores difference of ( $Mg = 11.85$ ) and ( $Mg = 5.96$ ), respectively. As evident from the results displayed, in all the groups, the males performed better than their female counterparts except in the Audio-video group, where the females performed slightly better than the males.

**Research Question 3:** What is the interactive effect of the use of audio-video-based, graphic-based multimedia instructional devices and gender on Biology students' performance scores when taught the concept of the circulatory system?

**Table 3: Joint effect of instructional strategies and gender on students' performance.**

Treatment Groups	Gender	n	Pre-test		Post-test		Mean Gain Score
			Mean	SD	Mean	SD	
Audio-video	Male	2	31.41	12.72	69.55	6.53	38.14
	Female	30	30.32	8.94	69.67	5.86	39.35
Graphics	Male	23	32.21	10.01	60.22	5.53	28.01
	Female	27	37.44	11.04	59.81	5.80	22.37
Lecture Method	Male	30	23.48	8.72	35.33	6.01	11.85
	Female	18	27.93	8.47	33.89	6.54	5.96
Total	Male	75	29.03	10.48	55.03	6.02	26.00
	Female	75	31.90	9.48	54.46	6.06	22.56

From Table 3, it revealed that the male and female students in the experimental group 1 (Audio-video based multimedia instructional devices) have a performance mean gain of ( $Mg = 38.14$  and  $Mg = 39.35$ ) respectively and the male and female students in the experimental group 2 (Graphics based multimedia instructional devices) have a performance mean gain as ( $Mg = 28.01$  and  $Mg = 22.37$ ) respectively while the control group, the male had performance mean gain of ( $Mg = 11.85$  and the female had  $Mg = 5.96$ ) as performance mean gain respectively. This shows that there has been an appreciable extent of progress in view of the additional scores gained after the post-test was administered, as evidence in the male scores in the Audio-video based multimedia instructional devices. It also showed that there is an interaction between teaching strategies and gender on students' performance scores.

**Hypothesis One:** There is no significant difference in the mean performance scores of Biology students taught the concept of the circulatory system using audio-video-based multimedia instructional devices, those taught using graphics-based multimedia instructional devices, and those taught using the lecture method.



**Table 4: Summary of Analysis of Covariance (ANCOVA) of the students' post-test scores classified by treatment groups**  
**Dependent Variable: Post-test Scores**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision at .05 alpha level	Partial Eta squared
Corrected Model	31950.936 <sup>a</sup>	3	10650.312	296.836	0.000	S	0.859
Intercept	43952.939	1	43952.939	1225.018	0.000	S	0.894
PRETESTSCORES	1.827	1	1.827	.051	0.822	NS	0.000
MULTIMEDIA STRATEGIES	31929.870	2	15964.935	444.961	0.000	S	0.859
Error	5238.397	146	35.879				
Total	495350.000	150					
Corrected Total	37189.333	149					

a. R Squared = .859 (Adjusted R Squared = .856), S= Significant at .05 alpha level, NS = Not significant at .05 alpha level

Table 4. Shows a value of  $F_{2,146} = 444.961$ ,  $P = 0.000$ , Partial eta squared = 0.859 ( $P < 0.05$ ) for mean performance scores of Biology students. The null hypothesis is therefore rejected. Therefore, there is a significant difference in the mean performance scores of Biology students taught the concept of the circulatory system using audio-video-based multimedia instructional devices, those taught using graphics-based multimedia instructional devices, and those taught using the lecture method. The partial eta squared value also shows that the instructional strategy has a large effect on student performance in the concept of the circulatory system.

With this observation, null hypothesis 1 was rejected. The direction of significance was determined using the Scheffe post hoc test in Table 5.

**Table 5: Scheffe Post Hoc tests for Post-test classified by treatment groups**

(I) MULTIMEDIA STRATEGIES	(J) MULTIMEDIA STRATEGIES	Mean Difference (I-J)	Std. Error	Sig. <sup>b</sup>	95% Confidence Interval for Difference <sup>b</sup>	
					Lower Bound	Upper Bound
AUDIO-VIDEO	GRAPHICS	9.640*	1.191	.000	7.285	11.995
	LECTURE METHOD	34.838*	1.201	.000	32.465	37.211
GRAPHICS	AUDIO-VIDEO	-9.640*	1.191	.000	-11.995	-7.285
	LECTURE METHOD	25.198*	1.211	.000	22.804	27.592
LECTURE METHOD	AUDIO-VIDEO	-34.838*	1.201	.000	-37.211	-32.465
	GRAPHICS	-25.198*	1.211	.000	-27.592	-22.804

Based on estimated marginal means

\*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).



The results in Table 5 show that a significant difference exists between the students taught using an audio-video-based multimedia device and those taught using graphics and the lecture method. Those in the lecture method group had the least performance, while the audio-video-based multimedia device achieved significantly better performance.

**Hypothesis Two:** There is no significant difference in the mean performance scores of male and female Biology students taught the concept of the circulatory system using audio-video, graphics-based multimedia instructional devices, and those taught using the lecture method.

**Table 6: Summary of Analysis of Covariance (ANCOVA) of male and female Biology students' post-test scores classified by treatment groups and gender with pretest scores as covariate**

Dependent Variable: Post-test Scores

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision at .05 alpha level	Partial Eta squared
Corrected Model	31976.044 <sup>a</sup>	6	5329.341	146.183	0.000	S	0.860
Intercept	43423.380	1	43423.380	1191.099	0.000	S	0.893
PRETESTSCORES	1.263	1	1.263	.035	0.853	NS	0.000
MULTIMEDIASTRATEGIE	30743.203	2	15371.602	421.641	0.000	NS	0.855
S							
GENDER	11.664	1	11.664	0.320	0.573	NS	0.002
MULTIMEDIASTRATEGIE	14.754	2	7.377	0.202	0.817	NS	0.003
S * GENDER							
Error	5213.289	143	36.457				
Total	495350.000	150					
Corrected Total	37189.333	149					

a. R Squared = .860 (Adjusted R Squared = .854), S= Significant at .05 alpha level, NS= Not significant at .05 alpha level

Table 6, shows a value of  $F_{2,143} = 0.202$ ,  $P = 0.817$ , Partial eta squared = 0.003 ( $P > 0.05$ ) for performance scores of male and female Biology students, indicating that there is no significant difference in the mean performance scores of male and female Biology students taught the concept of circulatory system using audio-video, graphics-based multimedia instructional devices and those taught using lecture method. With this observation, null hypothesis 2 was retained. The partial eta squared value shows that instructional strategy has a small effect on gender.

**Hypothesis three:** There is no significant interactive effect of the use of audio-video-based, graphic-based multimedia instructional devices and gender on Biology students' performance scores when taught the concept of the circulatory system.



**Table 7: Summary of Analysis of Covariance (ANCOVA) of male and female students' post-test scores classified by treatment groups and gender with pre-test scores as covariate**

**Dependent Variable: Performance Scores**

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision at .05 alpha level	Partial Eta Squared
Corrected Model	31976.044 <sup>a</sup>	6	5329.341	146.183	0.000	S	0.860
Intercept	43423.380	1	43423.380	1191.099	0.000	S	0.893
PRETESTSCORES	1.263	1	1.263	.035	0.853	NS	0.000
MULTIMEDIASTRATEGI ES	30743.203	2	15371.602	421.641	0.000	NS	0.855
GENDER	11.664	1	11.664	.320	0.573	NS	0.002
MULTIMEDIASTRATEGI ES * GENDER	14.754	2	7.377	.202	0.817	NS	0.003
Error	5213.289	143	36.457				
Total	495350.000	150					
Corrected Total	37189.333	149					

a. R Squared = .860 (Adjusted R Squared = .854), S= Significant at .05 alpha level, NS= Not significant at .05 alpha level.

Table 7 shows a value of  $F_{2,143} = 0.202$ ,  $P = 0.817$ , Partial eta squared = 0.003 ( $P > 0.05$ ) for the interaction effects of use of audio-video based, graphic-based multimedia instructional devices, lecture method, and gender on Biology students' academic performance on the concept of circulatory system. This shows that there is no significant interactive effect of the strategy and gender on Biology students' performance scores when taught the concept of the circulatory system. Therefore, the null hypothesis is retained. The partial eta squared value shows that instructional strategy has a small interactive effect on gender.

### Discussion of Findings

The findings of this study discovered that students taught using audio-video-based multimedia devices achieved significantly better performance compared with those taught using graphics and the lecture method. That means there was a significant difference in the strategy on the students' academic performance. The findings of this study agreed with Osemwinyen (2018), who reported that students taught the circulatory system using e-learning (audio-video aids) performed better than those taught the same topic using the conventional lecture method. The findings of this study also agreed with Babasola (2015) who reported that the achievement scores of students taught with Video and Audio Aided Instruction were higher than their counterparts taught with the conventional lecture method and also agrees with, Akara and Avwiri, (2025) who worked on the effect of instructional strategy on Physics students' academic performance in secondary schools in Rivers State and found out that flex instructional



strategy had a significant effect on the mean performance of students in Physics and also agrees with Akinbadewa (2020) on the study on impact of computer-based multimedia education packages on the academic performance of biology students in senior secondary school in Ibadan, Oyo State, Nigeria, the findings revealed a significant impact of strategy on students' achievement in Biology. This therefore implies that Multimedia educational packages greatly improved students' acquisition of the Biology concept better than the conventional technique. Considering gender, multimedia devices, and Students' Academic Performance, the findings of this study shows that there is no significant difference in the mean performance scores of male and female Biology students taught the concept of the circulatory system using audio-video, graphics-based multimedia instructional devices, and those taught using the lecture method. The findings of this study agreed with Akpan (2015) who reported that there were no statistical significant differences between girls and boys in their ability to manipulate the apparatus equipment, take observation, report/record results correctly, and computer/interpret/analyse results during physics practical.

The findings of this study also agreed with Adigun et al (2015), who reported that even though the male students had slightly better performance and retention compared to the female students, and disagrees with Obafemi (2015) who carried out a work on bridging the gender gap in Physics classroom: the instructional method perspective in Ikwerre Local Government Area of Rivers State, where the students were taught light waves, and found out that there is a significant difference between the male and the female students, with the male students showing the highest performance.

On the interactive effect of Multimedia Devices and gender on students' performance, the study further revealed that there is no significant interaction effect between the teaching strategy and gender for students' performance in Biology. This study agrees with Macaulay and Obafemi, (2022), who investigated gender and instructional strategy as predictors of students' performance in electrolysis in Obio-Akpor Area of Rivers State. And discovered no significant difference in the joint interaction between gender and strategy on performance, and also agreed with Avwiri and Uwadike (2026) who found no significant joint effect of teaching strategy and gender on students' performance in Physics, when they carried out a study on the effect of meta-conceptual and scaffolding instruction on senior secondary students' Physics achievement. Evidence from Ikwerre, Rivers State.



### Recommendations

The following were the recommendations made based on the findings of this research work.

1. The use of multimedia strategy in teaching and learning of the circulatory system should be encouraged by teachers in higher institutions of learning.
2. Considering the importance of audio-video-based multimedia as an instruction method, Government and curriculum planners should organize science teachers on the use of this media.
3. There is a need to do more research on the use of audio-video-based multimedia in teaching and learning in other science subjects to help improve students' performance.

### References

- Adigun, O., Onihunwa, I., Irunokhai, E., Sada, S., & Adesina, A. (2015). "Relationship between Students' Gender, Academic Performance, and Retention in Computer Science." *Journal of Computer Education Research*, 23(1), 34-50.
- Akara and Avwiri, (2025) Effect of Flex instructional strategy on Physics students' academic Performance in secondary schools in Rivers State. Nigeria. *Journal of Research in Contemporary issue*. Vol 21 (7) 30-43 ISSN: 3437-5482
- Akinbadewa, B.O. (2020). The effect of multimedia instructional packages on students' academic achievement in Biology. *International Online Journal of Education and Teaching (IOJET)*, 7(4). 1266-1281.
- Akpan, U. (2015). "Gender Differences in the Performance of Practical Skills on Physics." *Journal of Science Education and Technology*, 24(5), 789-801.
- Avwiri and Uwadileke (2026) Effect of Meta-conceptual and Scaffolding instruction on senior Secondary students Physics Achievement. Evidence from Ikwerre, Rivers State. *Asia Journal of Education and Social Studies*. Vol. 52, Issue 2, 25-35, Article No. AJESS. 151989 ISSN: 2581-6268.
- Babasola, K. (2015). "Video and Audio Aided Instruction in Senior Secondary School Mathematics." *Mathematics Education Journal*, 22(4), 123-140.
- David, S. (2017). "Effect of Audio-Video Based Instructional Method on Slow Learners in Social Studies." *International Journal of Inclusive Education*, 25(1), 78-92.
- Macaulay, A.U. & Obafemi, D.T.A. (2022) Gender and Instructional strategy as predictors of students' performance in electrolysis in Obio-Akpor Area of Rivers State. *International Journal of Advance Academic Research (IJAAR)* 8(3)



- Mayer, R. (2016). "The Impact of Audio-Visual Materials on Skill Demonstration in Learning." *Educational Psychology Review*, 22(4), 401-419.
- Obafemi, D.T.A. (2015). Bridging gender gap in the Physics classroom: The instructional method perspective. *Journal of Education and Practice*, 60.30
- Oghenevwede, O. E. (2019). Enhancing Biology Students' Academic Achievement and Attitude through self-Regulated Learning Strategy in Senior Secondary Schools in Delta Central Senatorial District. *Journal of Educational and Social Research*,[S.I.], 9(4),149.
- Osemwinyen, A. (2018). "Effects of E-learning on Achievements in Secondary School Biology." *Journal of Educational Technology*, 12(3), 45-62.
- WAEC (2023). Chief Examiners' Report for Biology.. Lagos: West African Examination Council

