

EFFECTIVENESS OF MULTIMEDIA INSTRUCTIONAL PACKAGE ON SECONDARY SCHOOL STUDENTS' ACADEMIC PERFORMANCE IN CHEMISTRY

Onuigwe, Blessing Ukamaka & EGOLUM, Evelyn O. (PhD)

Department of Science Education, Nnamdi Azikiwe University, Awka

Abstract

The study investigated the effect of multimedia instructional package on secondary school students' academic performance in Chemistry. Three research questions guided the study and three null hypotheses were tested at .05 level of significance. The design adopted for this study was quasi-experimental design. Specifically the design is a pretest-post test non-equivalent control group design. The population of the study consisted of 2,109 SS1 students made up of 1,027 males and 1,082 females in 2020/2021 academic session in public secondary schools in Enugu Education Zone of Enugu State. The sample for this study comprised 415SS1 students drawn using multistage sampling procedure. The instruments for data collection were titled "Chemistry Performance Test (CPT) which was duly validated by three experts from Faculty of Education, Nnamdi Azikiwe University, Awka. The reliability of CPT was determined using Kuder-Richardson formular 20 (k-R20) which yielded 0.84. Mean and standard deviation were used to answer the research questions and Analysis of Covariance (ANCOVA) to test the hypotheses. The findings of the study revealed among others that students taught Chemistry using multimedia instructional package effectively performed more than those taught using conventional teaching method. It is also revealed there was a significant difference between Chemistry students taught with multimedia instructional package and those taught with conventional teaching method in favour of those taught with multimedia instructional package.. Based on the findings, recommended and conclusions were made.

Keywords: Education, Chemistry, Multimedia Instructional Package and Performance.

Introduction

Education is critical for the advancement of science and technology, which contributes to the advancement of humanity. Science and technology play critical roles in the growth of nations around the world. As a result, education in the sciences and scientific education become critical for emerging countries to compete with developed countries. Science education is essential tool for achieving a society's technological growth and it also can assist a person in developing and realizing of their full potential.

According to Ogunode and Jegede (2019) science programs in Nigerian schools are given maximum attention due to their significant contribution to technological development of the country. It is extremely difficult for any nation to advance technologically if science education is not prioritized.

Obikezie et al (2020) defined science as a body of knowledge, a way of investigation and thinking in pursuit of an understanding of nature. The authors further stated that science is studied in school because it plays a vital role in the lives of individuals and the

development of a nation. Sciences in senior secondary schools are done in three major subject areas namely Biology, Chemistry and Physics. For the purpose of this study, Chemistry was considered.

Chemistry is one of the science subjects that occupy a central place in secondary schools curriculum, offering insights into the structure of matter, chemical reactions and real- world application. Itikpo, John and Ozoji (2021) defined Chemistry as branch of science that deals with changes in matter. Chemistry is a subject that deals with the study of matter and its behaviour when exposed to varying temperatures and pressure conditions. According to Samuel and Ukpoh (2021), Chemistry is the scientific study of the interaction of chemical substances that are constituted of atoms or subatomic particles: protons, electrons and neutrons. In the context of this study, Chemistry is the science that is concerned with composition, structure and properties of matter and the way that they react with other matters.

Oginni, Awobodu, Alanka, and Saibu (2013) Chemistry is commonly viewed “central science” as mastery of its concepts regarding the structure of matter serves as a foundation to further study in all sciences, the author further stated that chemistry performs the function of gate keeper for the future study of both pure and applied science, medicine, pharmacy, Engineering, Agricultural and all other professions at the secondary school level.

Proficiency in chemistry is not only crucial for academic success but also for understanding and addressing contemporary global challenges such as environmental sustainability, health and technology. The teaching of Chemistry to students enables them to acquire knowledge and skills to understand and solve environmental issues such as various forms of pollution and global warming. Idika (2021) noted that chemistry students have a better chance of understanding global problems such as water and air pollution, poverty and global warming. Chemistry is a subject of universal interest in human development with regards to the utility of its knowledge in real life situations which is likely to be faced by many students Ahmad(2012).. Despite the importance of Chemistry to humanity it is observed that students’ performance in the subject is unsatisfactory.

According to WACE Chief Examiners’ Report(2016 to 2021), showed that there is Chemistry student’s poor academic achievement in Chemistry paper 2 (theory) over the years. This arises from students’ having difficulties in tackling questions that required explanation and plotting of graphs. According to some researchers, one of the contributing factors to students’ difficulty in learning Chemistry arises as a result of use conventional method in teaching the subject (Obikezie et al, 2020; Ibe et al 2021). The conventional method is the instructional strategy in which the teachers use the chalk- and- talk approach in teaching the student. Achufusi-Aka and Okpanachi (2021)observed that it is a common practice in Nigerian secondary for the teacher to stand by chalk and deliver lesson without students active participation. Oghomwen, Abdullahi, Kolo and Karickson(2021) noted that the conventional method can no longer meet the needs of our instructional delivery method and hence they gradually being replaced with multimedia technology which has the ability of making information and objects available in learning environment with speed and practical approach. Other researchers also asserted that these weaknesses in Chemistry

subject may be overcome by use of innovative teaching methods like cooperative teaching method, computer assisted instructions, multimedia instructional package e.t.c, (Egolum & Igboanugo (2017), Obikezie et al. 2021). For the purpose of this study, multimedia instructional package was considered.

In recent years, there has been a growing recognition of the potential of multimedia instructional packages to enhance the teaching and learning of science subjects, including chemistry. Harlliru and Muhyideen (2018) defined multimedia instructional package as a platform designed to solve problems of teaching and learning through the use of audio, audio visual, graphics, and animations to facilitate learning. Murali and Jaise (2016) asserted that multimedia allows teachers to address various levels of students in a classroom due to the fact that it enables students to see, hear, and imagine what is being taught thereby help increase students' academic performance in any subject. Multimedia tools encompass a range of technologies, from video lectures and animations, to interactive stimulations and digital textbooks. These tools have the capacity to present complex concepts in a more accessible and interactive manner, catering to the diverse learning preferences of students in the digital age. Akinbobola (2015) averred that since all students have different learning styles, it is the function of the teacher to identify these learning styles and find appropriate instructional strategies that will match the preferred styles in order to enhance effective teaching and learning process for improvement on academic performance

Academic performance is the assessment of a student's ability in a variety of academic areas; Class room performance, graduation rate and standardized test that are commonly used by teachers' and education administrators to evaluate the students accomplishment. Shahjahan, et al (2021). Performance is assessment and examination is the criteria for analyzing ones level of academic performance. Through a comprehensive review of existing literature and an empirical investigation involving a diverse group of students, so many findings have been made to give insight into the use of multimedia as a pedagogical approach. Akinbadewa and Sofowora (2020) reported that multimedia instructional packages used in teaching and learning Biology in secondary schools prove effective to students' performance than the use of conventional teaching method. The authors further revealed that there was no significant difference in academic performance between male and female students taught Biology using multimedia instructional packages. Similarly, Alamina and Otuturu (2019) revealed that female students had a greater academic performance than their male counterpart in the use of multimedia instructional package because the package significantly enhanced academic performance of female students in Biology than their male counterpart but there was no significant difference between male and female students taught with multimedia instruct. Ayodeji (2021) revealed among others that the performance of students taught mathematics using multimedia instructional strategy was significantly better than the performance of students taught mathematics using conventional method thereby making multimedia instructional package more effective to conventional method. The author further revealed that there was no significant difference in the academic performance of male and female students taught mathematics using multimedia instructional strategy. Eze et al (2020) revealed that

teaching with multimedia was more effective in enhancing student's performance in mechanical trade.

From the look of things, it seems that most of the studies done as cited above on multimedia instructional packages were done in other areas like Mathematics, Mechanical trade and Biology. From the researchers best of knowledge, no work has been done on effectiveness of multimedia instructional strategy on secondary school students academic performance in Chemistry. Secondly, base on WAEC individual Chief examiners' report 2016-2021, students weaknesses in Chemistry paper 2 (theory) are noticed in plotting of graph especially in separation methods, atomic structure, chemical industry related questions, Boyle's law and Charles law. According to the report, this has contributed to low performance of students in senior secondary school certificate examination in those years. Base on this, the researchers wish to investigate whether multimedia instructional packages can effectively enhance secondary school Chemistry students' academic performance in Enugu state.

Purpose of the Study

The purpose of this study was to investigate the effectiveness of multimedia instructional package on secondary school students' academic performance in Chemistry in Enugu state. Specifically, the study sought to investigate the:

5. The mean performance scores of Chemistry students taught with multimedia instructional package and that of those taught using conventional teaching method
6. The mean performance scores of male and female students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method
7. The interaction effectiveness of gender and multimedia instructional package on students' academic performance scores in Chemistry.

Research Questions

The following research questions guided the study:

1. What are the mean performance scores of Chemistry students taught with multimedia instructional package and that of those taught using conventional teaching method?
2. What are the mean performance scores of male and female students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method?
3. What is the interaction effect of gender and multimedia instructional package on students' academic performance scores in Chemistry?

Hypotheses

The following hypotheses were tested at 0.05 level of significance.

1. There is no significant difference in the mean performance scores of students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method.

2. There is no significant difference in the mean performance scores of male and female students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method.
3. There is no significant interaction effectiveness of gender and multimedia instructional package on students' academic performance scores in Chemistry.

Methods

The design of the study was a quasi-experimental design. Quasi-experimental design is an experiment where a random assignment of subjects to experimental or control group is not possible (Nworgu, 2015). The population of the study was 2,109 SS1 Chemistry students in Enugu Education Zone. The sample for the study comprised of 415 SS 1 Chemistry students from four schools used for the study in Enugu Education Zone of Enugu State using multistage sampling procedure. Purposive sampling technique was used to draw four schools from the Enugu education zone on the basis that most schools selected have double streams of Chemistry classes, most of whom have presented candidates in secondary school senior certificate examination for at least five years and have qualified Chemistry teachers of not less than six years of experience. Simple random sampling technique was used to draw four intact classes from the six science classes from the two schools used for the study which were assigned to both experimental and control groups. The two schools (treatment group) that were exposed to multimedia instructional package consisted of 198 students (95 males and 103 females) and the two schools (control group) who were exposed to conventional teaching method constituted of 217 students (99 male and 118 female). The study covered a period of four weeks. First week was for familiarizing visit with the Chemistry teachers in the selected schools who act as research assistants. First day of the second week was used to administer a pretest achievement test to all the Chemistry students involved in the study. Second day of the second week was used to teach the Chemistry concepts of separation methods, chemical industry, atomic structure and Boyle's law and Charles's law in the experimental group schools using multimedia instructional package of computer animation in treatment group and conventional teaching method in control group for three weeks. The Chemistry teachers were given detailed information and instructions concerning the study. The teachers in the two groups used lesson plan prepared by the researchers for multimedia instructional package of computer animation and convention teaching method. At the end of the fourth week, both experimental groups and control group was post tested based on what they are taught. Marks were awarded to each question prepared for both experiment test groups and control group performance test which constituted twenty (20) multiple choice questions. If all the questions were answered correctly by the student, his/she is entitled to twenty (20) marks that is one mark per questions. The pre test scores were recorded as performance of the students in the two groups. Post test scores were recorded also as performance of the students when taught with multimedia instructional package and conventional teaching method. The reliability of the instrument was established using Cronbach alpha at 0.84. The instruments for data collection were Chemistry Performance Test (CPT) which was designed by the researchers. The CPT consisted of 20 items taken

from West African Senior School Certificate Examination (WASSCE) Chemistry past questions but modified by the researchers based on the focused topics of separation methods, chemical industry, atomic structure and Boyle's law and Charles's law. To ensure the reliability of the instrument, the twenty five (20) objective questions were administered on a group of forty students outside the place of this study after face and content validation of three expert, two from Department of Science Education Nnamdi Azikiwe University Awka, and one from Department of Educational Foundation Nnamdi Azikiwe University Awka. The results were subjected to Kuder 20 Richardson test to determine the reliability coefficient. A mean coefficient of 0.84 was obtained Mean and standard deviation was used for answering research questions and Analysis of Covariance (ANCOVA) used to test the hypotheses.

Results

Research Questions 1

What are the mean performance scores of Chemistry students taught with multimedia instructional package and that of those taught using conventional teaching method?

Table 1: Mean Pre-test and Posttest Performance Scores of Students taught Chemistry using MIP and those taught using CTM

Method	N	Pretest Mean	Posttest Mean	Mean Gain	Pretest SD	Posttest SD
MIP	198	38.05	86.31	48.26	6.64	4.35
CTM	217	32.49	60.04	27.55	5.01	3.99

Data presented on Table 1 showed that students taught Chemistry with multimedia instructional package had pre-test mean performance score of 38.05 with standard deviation of 6.64, their posttest mean performance score was 86.31 with 4.35 value of standard deviation and mean gain of 48.26. Those students that were taught Chemistry with conventional teaching method had pre-test mean performance score of 32.49 with standard deviation of 5.01, their posttest mean performance score was 60.04 with 3.99 values of standard deviation and 27.05 mean gains.

The mean performance gain difference between students taught Chemistry using multimedia instructional package and those taught using the conventional teaching method was 20.71 in favour of the experimental group. The result indicated that students taught Chemistry using multimedia instructional package had higher performance score than those taught using conventional teaching method.

Research Questions Two

What are the mean performance scores of male and female students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method?

Table 2: Mean Pre-test and Post-test Performance Scores of Male and Female Students taught Chemistry using Multimedia Instructional Package and that of those taught using Conventional Teaching Method

	Gender	N	Pretest Mean	Posttest Mean	Mean Gain	Pretest SD	Posttest SD
MIP	Male	95	30.01	87.08	57.07	5.01	4.47
	Female	103	27.43	76.11	48.68	5.08	4.03
CTM	Male	99	21.05	79.67	58.62	5.76	5.15
	Female	118	19.99	71.81	51.82	5.99	5.38

Table 2 shows that the male students taught Chemistry using multimedia instructional package had mean gain performance score of 57.07, while the females had mean gain performance score of 48.68. The mean performance gain difference between male and female students taught Chemistry using multimedia instructional package was 8.39 in favour of male students. The results show that the male students Chemistry using multimedia instructional package yielded greater mean gain performance score than female students. The male students taught Chemistry using conventional method had mean gain performance score of 58.62, while the females has mean gain performance score of 51.82. The mean performance gain difference between male and female students taught Chemistry using conventional teaching method was 6.8 in favour of male students. The results show that the male students taught Chemistry using conventional teaching method yielded greater performance mean gain score than female students. The findings indicated that male students taught Chemistry using multimedia instructional package and conventional teaching method yielded greater mean performance score than female students.

Research Questions 3

What is the interaction effect of gender and multimedia instructional package on students' academic performance scores in Chemistry?

Table 3: Mean and standard deviation of interaction effect of gender and multimedia instructional package on students' academic performance in chemistry

	Gender	N	Mean	Standard Deviation
Experimental Group	Male	95	39.44	3.57
	Female	103	35.03	3.40
Control Group	Male	99	31.02	3.27
	Female	118	29.40	3.21

Result of the analysis in Table 3 revealed that male students exposed to experimental group (multimedia instructional package) had a higher mean performance score of 39.44 and standard deviation of 3.57 as against their male counterpart exposed to conventional method that had mean performance score of 31.02 with standard deviation of 3.27. On the other hand, female students exposed to experimental group (multimedia instructional package) had a higher mean performance score of 35.03 and standard deviation of 3.40 as against their female counterpart exposed to conventional method that had mean

performance score of 29.40 with standard deviation of 3.21. The results do not suggest ordinal interaction effect between gender and multimedia instructional package on students' performance in Chemistry. This was because at all the levels of gender, the mean performance scores were higher for students in the experimental group than those in the conventional method.

Hypothesis One

There is no significant difference in the mean performance scores of students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method.

Table 4: ANCOVA on Difference between the Mean Performance Scores of Students taught Chemistry using Multimedia Instructional Package and that of those taught using Conventional Teaching Method

Source of variation	SS	Df	MS	F	P-value	Decision
Corrected Model	31301.622 ^a	2	15650.811	433.220	.001	
Intercept	27654.117	1	27654.177	3082.087	.000	
Pretest	.496	1	.496	.089	.765	
Method	20087.111	1	20087.11	568.102	.001	Sig.
Error	24779.119	76	326.041			
2Total	11232.901	79				
Corrected Total	16543.407	78				

Table 4 shows that at 0.05 level of significance, 1df numerator and 91 df denominator, the calculated F is 568.102 with p-value of .001 which is less than 0.05. Thus, the null hypothesis was rejected. Therefore, there is significant difference in the mean performance scores of students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method in favour of those taught with multimedia instructional package.

Hypothesis Two

There is no significant difference in the mean performance scores of male and female students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method.

Table 5: ANCOVA for Testing Significance Difference in the Mean Performance scores of male and female students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method

Source	SS	Df	Mean Square	F	Sig.	Decision
Corrected Model	46754.366 ^a	4	11688.592	454.117	.000	
Intercept	33478.654	1	33478.654	3160.120	.000	
Pretest	.076	1	.076	.020	.854	
Gender	38876.235	1	38876.235	917.110	.074	

Method	287.453	1	287.453	8.117	.081	
Method * Gender	8.866	1	8.866	.831	.310	Not Sig.
Error	4090.777	92	44.465			
Total	3981.144	95				
Corrected Total	3753.108	94				

Table 14 shows that at 0.05 level of significance, 1df numerator and 91 df denominator, the calculated F is 0.831 with p-value of 0.310 which is greater than .05. Thus, the null hypothesis was not rejected. Therefore, there is no significant difference in the mean performance scores of male and female students taught Chemistry using multimedia instructional package and that of those taught using conventional teaching method.

Hypothesis Three

There is no significant interaction effect of gender and multimedia instructional package on students' academic performance scores in Chemistry.

Table 6: ANCOVA for testing significance of interaction effect of gender and multimedia instructional package on students' performance in chemistry

Source	SS	Df	Mean Square	F	Sig.	Decision
Corrected Model	37113.113 ^a	4	9278.278	100.113	.000	
Intercept	45655.515	1	45655.515	2454.141	.000	
Pretest	.245	1	.245	.007	.611	
Gender	34324.113	1	34324.113	710.113	.002	
Method	161.186	1	161.186	5.1690	.010	
Method * Gender	7.008	1	7.008	.443	.167	NS
Error	1767.909	81	19.864			
Total	32146.154	86				
Corrected Total	22343.511	85				

Table 6 shows that at 0.05 level of significance, 1df numerator and 91 df denominator, the calculated F is 0.443 with P value of 0.167 which is greater than 0.05. Thus, the null hypothesis was not rejected. Therefore, there is no significant interaction effect of gender and multimedia instructional package on students' performance in Chemistry.

Discussion

The finding of the study revealed that students taught Chemistry using multimedia instructional package had higher performance score than those taught using conventional teaching method and there was a significant difference between Chemistry students taught with multimedia instructional package and those taught with conventional teaching method in favour of those taught with multimedia instructional package. This is in line with the finding of Ayodeji (2021) who revealed that the performance of students taught mathematics using multimedia instructional strategy was significantly better than the performance of students taught mathematics using conventional method. The findings is also in line with that of the study of Akinbadewa and Sofowora (2020), who reported that multimedia instructional packages used in teaching and learning Biology in secondary

schools proved better to students' performance than the use of conventional teaching method. The result is also inconsonance with the findings of Ayodeji (2021) and Eze et al (2020) who revealed that there was no significant difference in the performance of male and female students taught mathematics and mechanical trade respectively using multimedia instructional strategy. The result of this study is probably due to the fact that visual feature of multimedia instructional package provides opportunity for teachers to present and explain instruction as they appear in real life. The study revealed that male Chemistry students taught with multimedia instructional package and conventional teaching method had a better performance than their female counterpart but there were no significant difference among them. The result was in line with the findings of Akinbadewa and Sofowora (2020) who revealed that there was no significant difference between male and female students taught Biology using multimedia instructional packages. The findings of this study was in contrast to that of Alamina and Otuturu (2019) who revealed that female students had a greater performance than their male counterpart in use of multimedia instructional package because the package significantly enhanced academic achievement of female students in Biology than their male counterpart. The no significant difference as revealed in this study could be as a result that multimedia instructional package take equal care of both genders in instruction.

Conclusions

Based on the result obtained from this study, it was concluded that the multimedia instructional package had proved to be an effective method of teaching Chemistry. Also, multimedia instructional package was found to be superior to conventional method of teaching Chemistry to senior secondary school students.

Recommendations

The researchers formulated the following recommendations based on the findings and conclusions made from the study:

1. Curriculum experts and planners should add or modify some contents in Chemistry curriculum to incorporate the use of multimedia instructional package in teaching of Chemistry to improve students' academic performance.
2. Chemistry teachers should use multimedia instructional package in teaching the subject in senior secondary schools.
3. Secondary Education Management Board should organize annual training programme for Chemistry teachers on the use of multimedia instructional package in teaching the subject.

REFERENCES

- Achufsi-Aka, N.N. & Okpanachi, E.E. (2021). Effect of collaborative learning strategy on students' academic achievement in chemistry in Onitsha Education Zone, Anambra State. *International Scholars Journal of Arts and Social Sciences Research*, 3(3), 182-189.
- Akinbadewa, B.O. & Sofowora, O.A. (2020). Effectiveness of multimedia instructional learning packages in enhancing secondary school students' attitudes toward biology. *International Journal on Studies in Education*, 2(2), 119-133.
- Alamina, J.I. & Otuturu, F.G. (2019). Effects of multimedia instructional package on students' academic performance in biology in senior secondary schools in Rivers State. *Rivers State University Journal of Education* (1), 74-83.
- Ayodeji, J.E. (2021). Effects of multimedia instructional strategy on senior school students' performance and retention in mathematics. *Anatolian Journal of Education*, 6(2), 193-206.
- Cyril, M.U. (2016). Effects of multimedia instruction on retention and achievement of basic machining skills in mechanical craft practice. *International Journal of Education and Information Technology*, 2(1), 1-7.
- Egolum, E.O. & Igboanugo, B.I. Effects of computer assisted instruction and power point presentation on academic achievement of secondary school chemistry students. *Journal of Science Education*, 13(1), 129-135.
- Eya, N.M. & Ezeh, D.N. (2020). Meta-analysis of influence of gender on students' academic achievement in chemistry in Nigeria. *Journal of Chemistry Society of Nigeria*, 45(4), 615 -619.
- Eze, T.I., Olumoko, B.O. & Obi, M. N. (2020). Effect of multimedia instructional strategy on students' academic achievement in mechanical trades in Technical Colleges. *Journal of Education and Development*, 4(2), 38-43.
- Ibe, F.N., Obikezie, M.C., Chikendu, R.E. (2021). Effect of improvised instructional materials on Chemistry students' academic retention in secondary schools. *Journal DOI: www. doi. org*
- Idika, M.I. (2021). Effect of visualized case-based learning strategy on students' academic performance in Chemistry in Ibadan Metropolis, Nigeria. *African Journal of Teacher Education*, 10(1), 106-126.
- Tikpo, G., John, F. & Delmang, T.K. (2021). The use of model-lead test strategy in enhancing achievement of senior secondary two students in organic chemistry in Benue State, Nigeria. *British Journal of Education*, 9(4), 81-92.
- Margaret Oginni, A., Yetunde Awobodu, V., Olusegun Alaka, M., & Olajide Saibu, S. (2013). School Factors as Correlates of Students' Achievement in Chemistry. *International Journal for Cross-Disciplinary Subjects in Education*, 3(Special 3), 1516–1523. <https://doi.org/10.20533/ijcdse.2042.6364.2013.0213>.
- Murali, V. & Jaise, J. (2016). Teacher-assisted multimedia instructional package-an assured modus to enhance basic process skills in physics of secondary school students. *International Journal of Innovative Research in Science, Engineering and Technology*, 5(10), 18646-18654.

- Nworgu, B.G. (2015). *Education research: Basic issues and methodology (3rded.)*. Enugu: University Trust Publishers.
- Obikezie, C. M., Abumchukwu, A. A & Eke, J. A. The challenges of e- learning faced by secondary school students in chemistry during COVID-19 lockdown in Awka South Local Government Area of Anambra State. *BSU Journal of Science, Mathematics & Computer Education*, 1 (2), 21-30.
- Oghomwen, J.S., Abdullahi, A.N., Kolo, J. & Karickson, P.K. (2021). Effects of multimedia technology on instructional delivery in commerce in selected secondary schools in Bida Metropolis. *International Journal of Management, Social Sciences, Peace and Conflict Studies*, 4(1), 347-354.
- Ojo, G.A. (2019). Effects of multimedia instructional materials on Ekiti state secondary school students' academic performance in social studies. *Social Science Education Journal*, 2(1), 143-149.
- Orodho, D.S. (2021). Efficacy of differentiated instruction and conventional methods on low achievers' interest in learning and gender. *ABC Research Alert*, 8(3), 115-128.
- Samuel, I.R., & Ukpoh, A. (2021). Influence of teachers' attitude towards practical chemistry on senior secondary schools students' interest and achievement in Nasarawa state, Nigeria. *International Journal of Innovative Psychology & Social Development*, 9(3), 139-149.
- WAEC, (2016-2021). Chief Examiners Report. Lagos: West African Examinations Council.