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# Appraisal on Perceived Multimedia Technologies as Modern Pedagogical Tools for Strategic Improvement on Teaching and Learning

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***Abstract*—**Secondary schools as part of the foundational level of education cannot afford to lag behind in using multimedia to improve the intellectual and creative capabilities among the teachers and students. This study investigated multimedia technologies as modern pedagogical tools for strategic improvement on the teaching and learning process. The study adopted a descriptive survey design. The population was the senior secondary school students and teachers in Kuje Area Council of Federal Capital Territory (FCT), Nigeria. A simple random sampling technique was used to select 250 students and 100 teachers. Cronbach's alpha statistical tool was used to obtain a reliability coefficient of 0.83 on validated questionnaires which were distributed to collect data from the respondents. Statistically, mean, standard deviation, percentage and partial correlation were used to answer the research questions while t-test and Chi-Square were used to test the postulated hypotheses at 0.05 level of significance. The findings showed that television sets, projectors and computers were the major multimedia facilities used for teaching and learning in the council, multimedia facilities had a high influence on teaching and learning. It was gathered that multimedia enriched teaching cognitive skills and psychomotor skills and developed concretization of abstraction on any subject matter. Some recommendations were made which included the provision of financial support to procure multimedia facilities to schools towards the attainment of educational objectives, provision of subsiding policies by the government on the importation of multimedia facilities, employment of competent and experienced technical staff should be employed to solve a series of technical problems in using multimedia facilities. Experimental research design on the effectiveness of multimedia facilities as modern pedagogical tools for strategic improvement on teaching and learning was proposed for future work.

***Index Terms*—**Multimedia, Technologies, Pedagogical Tools, Teaching and Learning

## I. Introduction

Education is a fundamental practice through which learning, skills, beliefs, values and habits are facilitated. The significance of education in the development of human and nations cannot be over-emphasized. Recently, the teaching and learning process in education is being restructured from traditional “face-to-face” and “chalk-to-board” to a technology-based. In the technology-based teaching-learning process, electronic devices are used for dissemination and acquisition of knowledge and skills [1]. Technology-based teaching and learning is principally a learner-centred method that promotes maximum attentiveness from the learners [2].

The roles played by educational technology cannot be over-emphasized at this present information age. Learners easily get attracted with the aids of educational technologies. Educational technology is the scientific approach of dissimilation and assimilation of information. Reference [1] opined that educational technology facilitates learning and enhance the academic performance of the individual. Reference [3] pointed out that educational technology most helpful tool in student-centred and problem-based learnings. According to [4], educational technology encompasses the use of technology in the classroom for effective discussion. Educational technology is a very significant tool in teaching, learning, information dissemination,

 

management of over-crowded classrooms and performance evaluation [5].

However, teachers remain the principal and driven forces towards the curriculum implementation of any school programme. In the National Policy on Education, it was stated clearly that no education system may rise above the quality of its teachers [6]. The teaching and learning processes in secondary schools have not been effective because of factors such as unqualified and untrained teachers, lack of instructional aids, overcrowded classrooms, and poor teaching methods among others [7]. The consequences of these problems are poor learning, poor student's assimilation, poor teaching and poor academic performance. Remarkably, the above-mentioned problems can be solved with the integration of various modern educational technologies in the teaching and learning processes. In providing solutions to these problems, the roles of multimedia cannot be over-emphasized an element of educational technologies [8].

Multimedia describes any electronic device that uses multiple elements such as text, audio, visual, graphical and animation for dissimilation of information [9]. Reference [10] stated that multimedia is a special type of media that uses multiple forms of characteristics to process and deliver information. Multimedia technology refers to computer-based applications that enhance effective communication among a group of an individual [11]. In multimedia technology, text, graphics, video, animation and sound are combined towards effective communication [1]. The teachers and students with diverse characteristics of teaching and learning could be equipped with relevant information through the use of multimedia and students were able to solve problems by means of collaboration, self-exploration, and active participation [10]. New knowledge for teachers and students are much more effectively acquired through the use of multimedia [12].

Reference [12] stressed that multimedia provides the room for enhancing the traditional "talk-and-chalk" method of teaching and learning. Furthermore, multimedia encourages peer learning and facilitates individual creativity and diverse innovation [4]. Few examples of multimedia devices are illustrated in Fig. 1.

Reference [13] opined that multimedia provides opportunities for the educational contents and instructions be repeated severally until the teachers and students are satisfied without physical and emotional disturbance. Teachers' instructions delivery could be effectively monitored for effective dissimilation and assimilation of instructions [14]. Reference [1] pointed out that multimedia in education could be implemented in individual, group, distance, open, and 'closed' learning modes [1].

The advantages of multimedia for effective teaching and learning include: easy to use for teaching and learning, enhancement of texts for better clarification and understanding, improvement over traditional audio-video presentations, gains and holds attention, enhancement of quick assimilation, multimedia is entertaining as well as educational, making teaching and learning interesting [15]. However, the disadvantages of multimedia are not limited to: facilities are expensive, not always easy to configure to suite some topics, requires special hardware for configuration and delivery of instructions and problems of hardware and software incompatibility [1]. Reference [16] classified media into electronic media, non-print media and print media. It was also revealed that multimedia enhanced the teaching and learning process at all levels of education. It was discovered that learning with multimedia would help to bridge the gap of shifting from the traditional approach of learning to learner-centred teaching [2].


Fig.1. Examples of multimedia devices

Despite the numerous benefits of multimedia in the educational sector, [17] highlighted some constraints to the use of multimedia. According to [17], these constraints were high price of multimedia facilities, lack of technical support for repairs and maintenance of multimedia facilities, inadequate multimedia manpower in schools, poor remuneration for teachers, poor attention of the government towards the development of ICT sector, inadequate funding of educational sector, insufficient teaching time, problem of over-dependence on fairly used computers, over-dependence of educational institutions on government for everything, limited/poor information infrastructure, large class size, lack of basic facilities, poor ICT policy/project implementation strategy, resistance to change by teachers and lack of interest by student [18]. Reference [19] stated that application of computer as an example of multimedia in education has contributed to the attainment of stated objectives in the teaching and learning process.

Since the society in which we live is characterized by regular changes in technologies, the educational system should not be left out. As we move through the information age, technological advances are changing and

 

our education sector is expected to experience the same changes. The present importance of computer applications in virtually all the fields of human endeavour such as engineering, medicine, education, banking, business among others cannot be overemphasized [20].

Every stakeholder in education is concern about the educational objectives and how students' academic performance could be enhanced through the use of multimedia technologies. This research was motivated by the critical questions on what are types of multimedia facilities available for teaching and learning, is there a relationship between teaching and learning of Computer Science and the use of multimedia, what benefits could be derived from the use of multimedia in the classroom. The motivation also included the challenges influencing the use of multimedia and how these challenges could be tackled to enhance the teaching and learning of Computer Science at all levels of education. The answers provided would help the stakeholders and other researchers as a piece of information on the relationship between the use of multimedia and teaching/learning.

The details of this paper are chronically structured and covered the literature of scholarly published articles on multimedia technologies as relating to teaching and learning. Other aspects included research design, the population for the study, sample and sampling technique, the instrument for data collection, the validity of the instrument, reliability of the instrument, data collection and method of data analysis. There were research questions put forward to guide the conduct of this research. The results were presented in tabular and graphical forms. The findings were summarized, conclusion and recommendations were made for future investigation.

## II. Review of Related Studies

Few related studies were critically reviewed as a platform to substantiate the needs for this research. Reference [21] carried out an experimental survey on selected 28 students in Bakırköy Final College. The finding revealed that there was a statistical relationship between the students' academic achievement in Geography courses and the use of multimedia facility such as animation technology. It was discovered by Ref. [21] that animation technology would keep on enhancing the academic achievement of students who utilize the technology. However, there was no information on the difference between private and public schools. This research attempted to bridge the gap by finding out if there is a significant difference between government and private schools' respondents in the challenges affect the use of multimedia for teaching.

Reference [22] stated that multimedia had numerous benefits in the teaching of the English language. In [22], it was suggested that multimedia should not be used thoughtlessly. There was a significant difference between the teachers and students who utilized multimedia for teaching and learning of the English language and their counterparts who did not utilize the technology. In Ref. [22], there was a difference, yet what is the relationship between the use of multimedia and teaching? This question was addressed in this research. If education policymakers have relevant information on the relationship between teaching and learning on the use of multimedia facilities in senior secondary schools, then efforts would be provided to the adoption as modern pedagogical tools for strategic improvement on teaching and learning.

Reference [23] opined that the use of multimedia had become an integral part of the teaching and learning process. The research of [23] was on the role of multimedia to learn the English language as either a second or foreign language. The finding revealed that multimedia improved learners' language learning skills. Noticeably, the contents of the English language and Computer Science are not similar. Therefore, if there was an improvement in learning the English language as published in [23], would such improvement be repeated in a science subject like Computer Science?

Reference [24] carried out research on the effectiveness of multimedia on students' achievement in Biology. The research involved control and experimental groups. It was discovered that teaching with multimedia was significantly promoted the achievement of students in biology compared to the traditional method. Also, this another subject area that has unrelated contents to Computer Science. Conversely, there was no information on the relationship between teachers' qualifications and level of multimedia accessibility for teaching. This research attempted to bridge the gap by finding out if there is a significant relationship between teachers' qualifications and level of multimedia accessibility for teaching. The finding would give a clear direction on the teachers' qualifications and the use of multimedia towards promoting quality of teaching among the schools' teachers.

The research of [25] focused on the students who learnt Pythagoras theorem through a traditional blackboard and digital learning platform. A digital learning platform was developed using Moodle software. The selected students were allowed to interact with the digital platform while other students were taught using the blackboard. The finding revealed that the students that used the digital learning platform performed better than their counterparts who used chalk and blackboard. In [25], there was no information on the adequacy of multimedia. Do schools have sufficient multimedia facilities despite numerous benefits of the technologies? This research provided information on the level of adequacy of multimedia that would be helpful to the stakeholders in education in the provision of multimedia devices for the schools.

Reference [26] investigated the relationship between the use of multimedia and performance of students in English language skills such as writing, speaking, listening and reading. It was revealed that the use of multimedia in English had a significant difference in teaching and learning different skills in the English language. In Ref. [26], no details on the relationship between teaching and learning on the use of multimedia

 

facilities. This question was addressed in this research. If education policymakers have relevant information on the effect of multimedia facilities on teaching and learning in senior secondary schools, then efforts would be provided to the adoption as modern pedagogical tools for strategic improvement on teaching and learning.

In [27], it was pointed out that educators were concerned about making learning experiences of students pleasant and fruitful. The finding of [27] indicated that the use of different multimedia facilities for different related subjects in Social Sciences could address difficulties in teaching and learning experiences of teachers and students. What were the multimedia facilities needed as modern pedagogical tools for strategic improvement in the teaching and learning process? Reference [27] could not specify the needed multimedia facilities for teaching and learning in Geography and History. However, this research would identify the major types of multimedia resources useful for teaching and learning of Computer Science in senior secondary schools. The educators could specifically procure multimedia that are useful for teaching and learning rather than buying multimedia that would not enhance teaching and learning processes.

Reference [28] showed an effective usage of multimedia in teaching and learning communication skills. The finding of [28] revealed that multimedia played a very significant role in teaching communication skills. The challenges encountered by the teachers and students on the use of multimedia were not presented in [28]. This research examined the challenges and provided major solutions to the challenges that affect the use of multimedia by the senior secondary schools' teachers and students.

## III. Statement of Problem

Recently, there has been an interest in the adoption of multimedia-enhanced content towards promoting the quality of teaching and learning in education. The teaching and learning processes had been fundamentally characterized by the use of traditional methods of "talk-and-chalk" and paper-based learning. Remarkably, the academic performance of students in various subjects especially at senior secondary certificate examination (SSCE) has constantly remained poor due to some problems such as over-crowded classroom, poor relationship between teachers and students in the classroom, inaccessible to quality textbooks, bullying, physical and emotional stress and engagement of unskilled teachers. This showed that students are not learning from the use of the conventional method of teaching and learning.

The consequences of traditional methods of teaching and learning in secondary schools were poor assimilation, tiredness, poor academic performance [10]. Meanwhile, Ref. [29] opined that for any student to be creative and sound in their academic pursuit, the adoption of multimedia facilities into teaching and learning would be fundamental at present information age. Reference [4] revealed that schools' children became irritated and bored with unqualified teachers during teaching, thereby negatively affect learning and academic performance. The non-regular payment of teachers' salary could as well be a major setback to effectively and efficiently deliver the required instructions. However, the use of multimedia does not require any form of motivation for effective delivery of instruction at all time [30]. What is the relationship between teaching and learning on the use of multimedia in senior secondary schools?. The scholars need to constantly find ways of providing specific solutions to specific problems. It is on the basis of the aforementioned problems that this study was conducted to investigate the multimedia facilities as modern pedagogical tools for strategic improvement on teaching and learning of Computer Science in Kuje Area Council, Abuja, Nigeria.

## IV. Research Questions

The following research questions were put forward to guide the conduct of the study:

1. What are the major types of multimedia resources useful for teaching and learning in senior secondary schools?
2. How adequate are the multimedia facilities for teaching and learning in senior secondary schools?
3. What is the level of multimedia accessibility for teaching and learning in senior secondary schools?
4. What is the frequency use of multimedia for teaching and learning by the senior secondary schools' students and teachers in Kuje Area Council?
5. What is the relationship between teaching and learning of Computer Science on the use of multimedia in senior secondary schools?
6. What are the perceived benefits of multimedia in teaching and learning of computer science?
7. What are the major challenges that affect the use of multimedia by the senior secondary schools' teachers in Kuje Area Council?
8. What are the major solutions to the challenges that affect the use of multimedia by the senior secondary schools' teachers in Kuje Area Council?

## V. Research Hypotheses

The following null hypotheses were postulated as a follow-up of the research questions.

1. There is no significant difference in the mean score between public and private schools' respondents in the challenges that affect the use of multimedia for teaching.
2. There is no significant difference in the mean score between male and female schools teachers on the frequency use of multimedia for teaching in senior secondary schools.

3. There is no significant relationship between teachers' qualifications and level of multimedia accessibility for teaching in senior secondary schools and increasing interest in the development and use of multimedia-enhanced content towards the quality of teaching.

## VI. Objectives of the Research

The aim of this study was to investigate multimedia as modern pedagogical tools for strategic improvement on teaching and learning of Computer Science in Kuje Area Council of Federal Capital Territory (FCT). Specifically, the objectives were:

1. To identify the major types of multimedia resources useful for teaching and learning in senior secondary schools;
2. To find out the adequacy of multimedia facilities for teaching and learning in senior secondary schools;
3. To examine the level of multimedia accessibility for teaching and learning in senior secondary schools;
4. To find out the frequency use of multimedia for teaching and learning by the senior secondary schools' students and teachers in Kuje Area Council;
5. To determine the relationship between teaching and learning of Computer Science on the use of multimedia in senior secondary schools;
6. To divulge the perceived benefits of multimedia in teaching and learning of computer science;
7. To identify the major challenges that affect the use of multimedia by the senior secondary schools' teachers in Kuje Area Council;
8. To find out the major solutions to the challenges that affect the use of multimedia by the senior secondary schools' teachers in Kuje Area Council;
9. To investigate if there is a significant difference between government and private schools' respondents in the challenges affect the use of multimedia for teaching;
10. To find out if there is a significant difference in the mean score between male and female teachers' schools on the frequency use of multimedia for teaching in senior secondary schools and
11. To determine if there is a significant relationship between teachers' qualifications and level of multimedia accessibility for teaching in senior secondary schools.

## VII. Significance of the Research

The researchers, educationalists and administrators are constantly concerned on the introduction of multimedia into educational institutions towards improving the learning and teaching modes. The facilitators in education would benefit immensely from this study. This study would help the facilitators to identify a variety of multimedia devices for improving teaching and students' learning experiences.

The policymakers in education would be provided with information on the adequacy of multimedia in secondary schools. The information would be useful to make policy towards the needs to equip the schools with relevant multimedia facilities that improving the quality of teaching and learning.

Also, the study would encourage the use of multimedia in the secondary schools towards making learning and teaching experiences pleasant for the students and teachers respectively. In recent times, researchers are on the lookout for the extent multimedia facilities influence teaching and learning, and the challenges that affect the use of multimedia in the senior secondary schools. This research would reveal the relationship between teaching and learning on the use of multimedia facilities Computer Science, and major challenges that affect the use of multimedia by the senior secondary schools' teachers. Perhaps, the findings and solutions to the challenges that affect the use of multimedia by the senior secondary schools' teachers in Kuje Area Council could be extended to other subjects for the enhancement of teaching and learning process.

In this light, the finding of this study would serve as an initiative and provide relevant information with respect to the use of multimedia facilities in education. The government could use the outcomes of the study to solve the teachers' problems especially high cost of technology, inadequate or lack of training on the use of multimedia and wrong choice of software or software inadequacy. Additionally, the findings of this research would provide significant empirical reports as pieces of literature for intellectual investigations.

## VIII. Research Methodology

The methodology adopted for this research was detailed as follows:

### *A. Research Design*

A descriptive survey was adopted for this research. The research design was used to enable the researchers to collect relevant data from the respondents (teachers and students) with respect to the assessment of multimedia technology towards improving teaching and learning of Computer Science in senior secondary schools.

### *B. Population for the Study*

The target population consisted of all senior secondary schools' teachers and students in Kuje Area Council of Federal Capital Territory (FCT). There are twelve (12) government senior secondary schools and eighteen (18) private senior secondary schools in the area council [31].

### *C. Sample and Sampling Technique*

A simple random sampling technique was used to select five (5) government and five (5) private secondary

schools for the study on the basis of twenty-five (25) students and ten (10) teachers per school. Therefore, a total of two hundred and fifty (250) SS III students and one hundred (100) teachers constituted the sample. This was made up of male and female students.

*D. Instrument for Data Collection*

The instrument used for data collection was a questionnaire, which consisted of statements with respect to multimedia technologies: modern pedagogical tools for strategic improvement in teaching and learning of Computer Science in senior secondary schools. The instrument consisted of two (2) sections. Section A was designed to obtain personal information about the respondent; Section B was divided into different tables that examine the type of multimedia resources being used for teaching and learning in senior secondary schools, level of multimedia accessibility for teaching and learning in senior secondary schools, frequency of use of the multimedia for teaching and learning by the senior secondary schools teachers, influence of multimedia facilities on teaching and learning in senior secondary schools, adequacy of multimedia facilities for teaching and learning and factors affect the use of multimedia by the senior secondary schools teachers. The respondents were required to provide responses on a 4-point Likert-type scale to their level of agreement with the statement given as "Strongly Agree", "Agree", "Disagree" and "Strongly Disagree".

*E. Validity of the Instrument*

A copy of the questionnaire was presented to the experts in Educational Psychology, and Measurement and Evaluation for face and content validity. The experts provided useful and constructive suggestions before the questionnaires were administered to students and teachers. After taking the concerns of the experts, the contents of the questionnaire were modified as suggested and instructed. The instrument was returned to the experts for corrections until the final copy of the questionnaire was produced for administration.

*F. Reliability of the Instrument*

A Test-retest method was used to determine the reliability coefficient of the instrument. The teachers and students of Government Secondary School (GSS), Suleja, Niger State of Nigeria were used as a pilot sample. The copies of the questionnaires were administered to the pilot sample on two different occasions at three weeks intervals. In order to determine the reliability coefficient, the data collected were analysed using Cronbach's alpha statistical tool in Statistical Package for the Social Science (SPSS). The alpha coefficient of 0.83 was obtained. With this alpha value, the instrument was considered reliable and suitable for use for this research.

*G. Data Collection*

The questionnaire was used by the researchers as the basic instrument for data collection with the help of five (5) other research assistants under the close supervision of the researchers. Two hundred and fifty (250) questionnaire forms were distributed to the students while one hundred (100) were distributed to the teachers. However, two hundred and twenty-eight (228) [91.2%] and eighty-three (83) [83%] forms could be retrieved from the students and teachers respectively. Others forms were either not returned or not properly filled. Out of this percentage, one hundred and two (102) were female students and one hundred and twenty-six (126) were male students. Also, there were forty-eight (48) male teachers and thirty-five (35) female teachers from five (5) public and five (5) private senior secondary schools. The data collected were weighed on a 4-point Likert-type scale of 4, 3, 2, and 1 as indicated by their level of agreement as contained in the retrieved questionnaire. The maximum and minimum scale values were 4 and 1 respectively. The responses were classified into two levels of low (disagreed, negative) and high (agreed, positive).

$$\frac{\text{Highest scale value} - \text{Lowest scalevalue}}{\text{Number of levels}} \quad (1)$$

Thus:

$$\frac{4-1}{2} = \frac{3}{2} = 1.5$$

Using the interval of 1.5, a mean range of 1.00 to 2.50 represented either “low” or “disagreed” response, and score greater than 2.50 represented either “high” or “agreed” response. Therefore, 2.50 was considered as the reference mean for judgment.

*H. Method of Data Analysis*

The data collected were analysed by using mean ($\overline{X}$), standard deviations (SD), frequency, percentages and Partial correlation statistical tools were used to answer the research questions while t-test and Pearson Chi-Square were used to test the postulated hypotheses at 0.05 level of significance. All these calculations were performed using IBM Statistical Package for Social Sciences (SPSS) 21 version for windows.

## IX. Results

The results of this research were presented as follows:

*A. Analysis of Research Questions*

The six (6) research questions were analysed as follows:

***RQ1*: What are the major types of multimedia resources useful for teaching and learning in senior secondary schools?**

Table 1 shows mean and standard deviation analysis of the type of multimedia resources being used for teaching and learning in senior secondary schools in Kuje Area Council of Federal Capital Territory, Abuja and

graphically represented in Fig. 2. The seven items a, b, c, d, e, f, and g had means 2.27, 1.21, 3.48, 3.16, 1.26, 3.19, and 1.09 respectively. The table further indicated there were three major multimedia facilities being used for teaching and learning in senior secondary schools in Kuje Area Council. These multimedia facilities included Television sets, Projectors, and Computers. Therefore, Television sets, Projectors, and Computers were major multimedia facilities useful for teaching and learning in senior secondary schools in Kuje Area Council of Federal Capital Territory, Abuja.

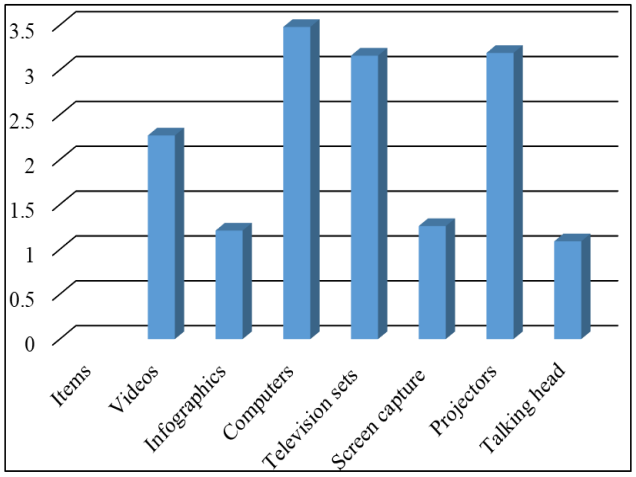


Fig.2. Types of multimedia resources

Table 1. Mean and standard deviation analysis of the types of multimedia resources

| s/n | Items | $\overline{X}$ | SD |
|---|---|---|---|
| 1 | Videos | 2.27 | 1.93 |
| 2 | Infographics | 1.21 | 1.27 |
| 3 | Computers | 3.48 | 0.23 |
| 4 | Television sets | 3.16 | 0.17 |
| 5 | Screen capture | 1.26 | 1.58 |
| 6 | Projectors | 3.19 | 0.24 |
| 7 | Talking head | 1.09 | 1.87 |

***RQ2*: How adequate are the multimedia facilities for teaching and learning in senior secondary schools?**

Table 2 shows the frequency analysis of the adequacy of multimedia facilities and graphically represented in Fig. 3. Table 2 above revealed that 271 (87.14%) of the respondents reported that the multimedia collections were grossly inadequate for teaching and learning; 21 (6.75%) ranked them as being inadequate; 13 (4.18%) indicated fairly adequate to their needs for teaching and learning while only 6 (1.93%) of the respondents reported that the multimedia were adequate for teaching and learning among the senior secondary schools in Kuje Area Council.

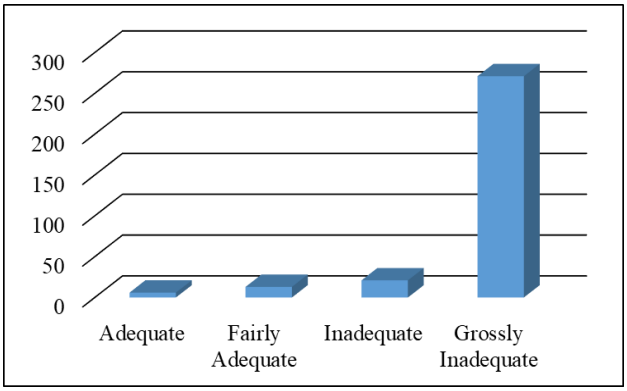


Fig.3. Adequacy of multimedia facilities

Table 2. Frequency analysis of the adequacy of multimedia facilities

| s/n | Level of adequacy | F | % |
|---|---|---|---|
| 1 | Adequate | 6 | 1.93 |
| 2 | Fairly Adequate | 13 | 4.18 |
| 3 | Inadequate | 21 | 6.75 |
| 4 | Grossly Inadequate | 271 | 87.14 |
| 5 | Total | 311 | 100 |

Conclusively, the multimedia facilities in the selected schools were wholly not adequate for teaching and learning as a majority (271, 87.14%) of the respondents reported.

***RQ3*: What is the level of multimedia accessibility for teaching and learning in senior secondary schools?**

Table 3 shows mean and standard deviation analysis of the accessibility to multimedia resources in Kuje Area Council of Federal Capital Territory, Abuja and graphically represented in Fig. 4. The "High" level of accessibility had a mean of 7.67, "Moderate" had 11.31 and "Low" had 22.27. This implies that there was low accessibility of multimedia resources in secondary schools in Kuje Area Council of Federal Capital Territory, Abuja.

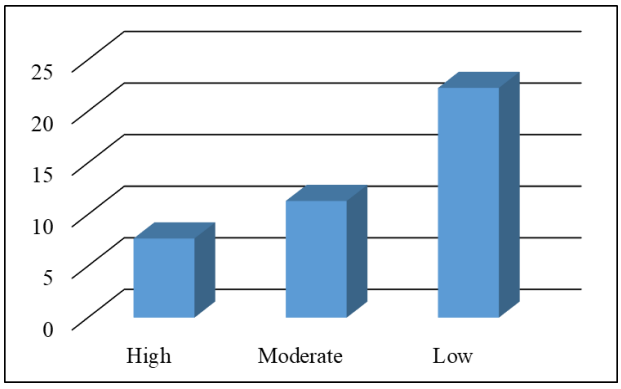


Fig.4. Multimedia accessibility

Table 3. Mean and standard deviation analysis of the accessibility to multimedia resources

| s/n | Accessibilities | $\overline{X}$ | SD |
|---|---|---|---|
| 1 | High | 7.67 | 0.17 |
| 2 | Moderate | 11.31 | 1.54 |
| 3 | Low | 22.27 | 5.78 |

***RQ4*: What is the frequency use of the multimedia for teaching and learning by the senior secondary schools' students and teachers in Kuje Area Council?**

Table 4 presents the frequency of use of multimedia resources by the secondary schools' teachers and students. A critical observation of the result showed that Computer had the highest frequency of use 269 (86.50%) with 127 (40.84%) using it very often and 142 (45.66%) often; followed by Projector 242 (77.81%) with 106 (34.08%) using it very often and 136 (43.73%) often while Television sets had 273 (87.78%) as rarely frequency of use with 15 (4.82%) using it very often and 23 (43.73%) often.

Table 4. Frequency analysis of the use of multimedia resources

| s/n | Items | Very Often | Often | Rarely | Never |
|---|---|---|---|---|---|
| 1 | Videos | 15 [4.82] | 23 [43.73] | 273 [87.78] | —— |
| 2 | Infographics | 106 [34.08] | 136 [43.73] | 39 [12.54] | 30 [9.65] |
| 3 | Computers | 127 [40.84] | 142 [45.66] | 39 [12.54] | 3 [0.96] |
| 4 | Television sets | 24 [7.72] | 38 [12.22] | 119 [38.26] | 130 [41.80] |
| 5 | Screen capture | | | 14 [4.50] | 297 [95.50] |
| 6 | Projectors | | | 3 [0.96] | 308 [99.04] |
| 7 | Talking head | | | —— | 311 [100] |

Table 4 further indicates Screen capture and Infographics had 297 (95.50%) and 308 (99.04%) respectively and were classified as never frequency of use. In all the multimedia facilities provided in the questionnaire, only Talking head had 100% never frequency of use. Conclusively, the computer was very often used by the secondary schools' teachers and students of Kuja Area Council.

***RQ5*: What is the relationship between teaching and learning of Computer Science on the use of multimedia in senior secondary schools?**

Table 5. Partial correlation analysis on multimedia facilities, teaching and learning

| Control Variables | | | Teaching | Learning |
|---|---|---|---|---|
| **Multimedia** | **Teaching** | Correlation | 1.000 | **0.718** |
| | | Sig. (2-tailed) | | **0.029** |
| | **Learning** | Correlation | 0.718 | **1.000** |
| | | Sig. (2-tailed) | 0.029 | |

The result in Table 5 showed partial correlation analysis of the relationship between teaching and learning on the use of multimedia facilities. The partial correlation coefficient, r of 0.718 indicated a positive relationship between teaching and learning of Computer Science on the use of multimedia in senior secondary schools. This statistical value revealed that the controlling effect of multimedia was strong in teaching and learning of Computer Science in Kuje Area Council of Federal Capital Territory.

**RQ6: What are the perceived benefits of multimedia in teaching and learning of computer science?**

Table 6 shows mean and standard deviation analysis of perceived benefits of multimedia in teaching and learning of computer science in Kuje Area Council of Federal Capital Territory, Abuja.

Table 6. Mean and standard deviation analysis of the perceived benefits of multimedia in teaching and learning

| S/n | Items | $\overline{X}$ | SD |
|---|---|---|---|
| 1 | Multimedia enrich teaching cognitive skills and psychomotor skills | 3.07 | 0.57 |
| 2 | Multimedia enhances collaboration among peers and colleagues | 3.26 | 0.69 |
| 3 | Multimedia develops concretization of abstraction on any subject matter | 3.27 | 0.61 |
| 4 | Multimedia facilities are suitable for classroom management | 3.24 | 1.91 |
| 5 | Multimedia improve retention of learning contents | 3.49 | 0.72 |
| 6 | Multimedia encourage modification of teaching and learning experiences | 3.27 | 0.51 |
| 7 | Multimedia promote teachers' and students' interaction with instructional contents repeatedly | 3.53 | 0.67 |
| | Grand Mean | 3.30 | |

The analysis further indicated a grand mean of 3.30. This statistical value was greater than the reference mean of 2.50. By implication, it was revealed that the respondents agreed with the researchers on the perceived benefits of multimedia in teaching and learning of computer science as contained in the questionnaire.

Thus, multimedia enrich teaching cognitive skills and psychomotor skills, develop concretization of abstraction on any subject matter, improve retention of learning contents, and encourage modification of teaching and learning experiences among other benefits.

***RQ7*: What are the major challenges that affect the use of multimedia by the senior secondary schools' teachers in Kuje Area Council?**

Table 7 shows mean and standard deviation analysis of challenges affecting the use of multimedia facilities in Kuje Area Council of Federal Capital Territory, Abuja.

Using the statistical values reported in Table 7, there were four major challenges identified. The major challenges to the use of multimedia were the high cost of multimedia technology, inadequate training on the use of

multimedia, lack of electricity (power supply) to operate the facilities and poor technical support for effective use of multimedia in schools.

Table 7. Mean and standard deviation analysis of challenges affecting the use of multimedia facilities

| S/n | Items | $\overline{X}$ | SD |
|---|---|---|---|
| 1 | The high cost of multimedia technology | 3.25 | 0.18 |
| 2 | Lack of supportive infrastructures | 2.28 | 0.51 |
| 3 | Lack of perceived economic or other benefits | 1.14 | 1.92 |
| 4 | Inadequate training on the use of multimedia | 3.54 | 0.43 |
| 5 | Lack of electricity (power supply) to operate the facilities | 3.65 | 0.21 |
| 6 | Poor technical support for effective use of multimedia in schools | 3.77 | 0.91 |
| 7 | Lack of qualified teachers to teach computers in schools | 2.25 | 0.18 |

***RQ8*: What are the major solutions to the challenges that affect the use of multimedia by the senior secondary schools' teachers in Kuje Area Council?**

Table 8. Mean and standard deviation analysis of solutions to challenges affecting the use of multimedia facilities

| S/n | Items | $\overline{X}$ | SD |
|---|---|---|---|
| 1 | Subsiding the tariffs on the importation of multimedia facilities | 3.06 | 1.47 |
| 2 | Training and development skills in the use of multimedia facilities | 3.37 | 1.66 |
| 3 | Employment of competent and experienced technical staff | 2.09 | 0.92 |
| 4 | Provision of financial support for the procurement of multimedia facilities | 3.54 | 1.93 |
| 5 | Supply of generators to avoid electrical power supply interruption during teaching and learning | 3.11 | 1.37 |
| 6 | Provision of infrastructures such as equipped laboratories, conducive classrooms | 3.24 | 1.67 |

Table 8 shows mean and standard deviation analysis of solutions to the challenges affecting the use of multimedia facilities in Kuje Area Council of Federal Capital Territory, Abuja. There were three main solutions revealed to the challenges affecting the use of multimedia facilities. Ranking these statistical values in ascending order, the major solutions to the challenges to the use of multimedia were the provision of financial support for the procurement of multimedia facilities, training and development skills in the use of multimedia facilities and provision of infrastructures such as equipped laboratories, conducive classrooms.

*B. Testing Research Hypotheses*

The postulated null hypotheses were subjected to test as follow at 0.05 level of significance.

***H01*: There is no significant difference in the mean score between public and private schools' respondents in the challenges that affect the use of multimedia for teaching.**

To determine whether there was a significant difference in the mean score between public and private schools' respondents in the challenges that affect the use of multimedia for teaching, data were analysed using the T-test statistical tool.

Table 9. T-test analysis of public and private respondents on challenges affect the use of multimedia

| Schools | N | $\overline{X}$ | SD | Df | t-cal | Sig. (2-tailed) |
|---|---|---|---|---|---|---|
| **Public** | 193 | 3.34 | 1.29 | 309 | 1.57 | 0.1152 |
| **Private** | 118 | 3.11 | 1.17 | | | |

*P(0.05)*

Table 9 shows t-test analysis between public and private schools' respondents on factors affect the use of multimedia for teaching. The table further indicates that the government respondents had a mean of 3.34 and a standard deviation of 1.29 while the private respondents had a mean of 3.11 and a standard deviation of 1.27. The calculated t-test value was 1.57 at the p-value of 0.05 level of significance. The computed p-value of 0.1152 was greater than the tested p-value of 0.05. Therefore, the hypothesis was accepted. This implies that there was no statistically significant difference in the mean score between public and private schools' respondents in the challenges that affect the use of multimedia for teaching in Kuje Area Council of Federal Capital Territory, Abuja.

***H02*: There is no significant difference in the mean score between male and female schools teachers on the frequency use of multimedia for teaching in senior secondary schools.**

To determine whether there was a significant difference in the mean score between male and female schools teachers on the frequency use of multimedia for teaching in senior secondary schools, data were analysed using the T-test statistical tool.

Table 10. T-test analysis of male and female teachers on the frequency use of multimedia for teaching

| Gender | N | $\overline{X}$ | SD | Df | t-cal | Sig. (2-tailed) |
|---|---|---|---|---|---|---|
| **Male** | 48 | 3.27 | 1.73 | 81 | 0.96 | 0.3415 |
| **Female** | 35 | 2.91 | 1.64 | | | |

*P(0.05)*

Table 10 shows a t-test analysis between male and female schools' teachers on the frequency use of multimedia for teaching. The table further indicates that the male schools' teachers had a mean of 3.27 and a standard deviation of 1.73 while the female schools' teachers had a mean of 2.91 and a standard deviation of 1.64. The calculated t-test value was 3.51 at 0.05 level of significance. The computed p-value of 0.3415 was greater than the tested p-value of 0.05. Therefore, the hypothesis was accepted. This implies that there was no statistically significant difference in the mean score between male and female schools teachers on the frequency use of

multimedia for teaching in senior secondary schools in Kuje Area Council of Federal Capital Territory, Abuja. This result was relatively similar to Reference [18] which indicated no significant relationship between computer utilization and students' academic performance.

***H03*: There is no significant relationship between teachers' qualifications and level of multimedia accessibility for teaching in senior secondary schools.**

To determine whether there was a significant relationship between teachers' qualifications and level of multimedia accessibility for teaching in senior secondary schools, data were analysed using the Chi-Square statistical tool.

Table 11 shows Pearson Chi-Square analysis on the relationship between teachers' qualifications and level of multimedia accessibility for teaching in senior secondary schools. The computed p-value of 0.517 was greater than the tested p-value of 0.05. Therefore, the hypothesis was accepted. This implies that there was no statistically significant relationship between teachers' qualifications and level of multimedia accessibility for teaching in senior secondary schools. By implication, the teachers' qualifications did not associate or guarantee the accessibility of multimedia.

Table 11. Chi-Square analysis of teachers' qualifications and level of multimedia accessibility for teaching

| Variables | | | Levels of multimedia | | | Total | Df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|
| | | | High | Moderate | Low | | | |
| Qualifications | M.Sc | Count | 0 | 8 | 3 | 11 | 4 | 0.517 |
| | | Expected Count | 0.8 | 6.9 | 3.3 | 11.0 | | |
| | B.Sc | Count | 4 | 35 | 14 | 53 | | |
| | | Expected Count | 3.8 | 33.2 | 16.0 | 53.0 | | |
| | NCE | Count | 2 | 9 | 8 | 19 | | |
| | | Expected Count | 1.4 | 11.9 | 5.7 | 19.0 | | |
| Total | | Count | 6 | 52 | 25 | 83 | | |
| | | Expected Count | 6.0 | 52.0 | 25.0 | 83.0 | | |

*P(0.05)*

## X. Conclusion

The significance of multimedia in the modern day's education cannot be over-emphasized. In conclusion, the researchers discovered that television sets, projectors, and computers were major multimedia facilities used for teaching and learning in senior secondary schools in Kuje Area Council of Federal Capital Territory, Abuja. It was discovered that there was a low level of accessibility of multimedia facilities for teaching and learning. This implies that efforts are required to improve the level of accessibility of multimedia resources as pedagogical tools for strategic improvement in teaching and learning in secondary schools. In addition, the finding indicated that multimedia facilities had a high impact on teaching and learning of Computer Science in senior secondary schools; multimedia facilities in the selected schools were not adequate for teaching and learning; the perceived benefits of multimedia as revealed included enrichment of teaching cognitive skills and psychomotor skills, development of concretization of abstraction on any subject matter, improvement on retention of learning contents, and encouragement on modification of teaching and learning experiences by the teachers and students among other benefits. The challenges affecting the use of multimedia identified were high cost of multimedia technology, lack of supportive infrastructures, inadequate or lack of/inadequate training, lack of electricity to operate the facilities and poor technical support for effective use of multimedia in schools, and there was no significant difference in the mean score between public and private schools' respondents in the challenges that affect the use of multimedia for teaching in Kuje Area Council of Federal Capital Territory, Abuja. It was discovered that there was no significant relationship between teachers' qualifications and level of multimedia accessibility for teaching in senior secondary schools. Conclusively, provision of financial support could enhance the use of multimedia facilities as modern pedagogical tools for strategic improvement on teaching and learning of Computer Science and by extension to other subjects at all level of education.

The significant contribution of this research cannot be over-emphasised as the stakeholders in education could be guided by a piece of empirical results provided on positive benefits of multimedia technologies in teaching and learning of Computer Science and strategically make policies that would improve the use of multimedia facilities in the classroom.

## XI. Recommendations

The following recommendations were made based on the findings of the study:

1. Subsiding policies by the government on the importation of multimedia facilities should be made so that schools could be adequately equipped for effective learning and teaching process.
2. Series of training and development skills in the use of multimedia facilities should be provided for adoption and application in teaching and learning process.

3. Adequate, competent and experienced technical staff should be employed to solve a series of technical problems in using multimedia facilities.
4. The federal government and non-governmental organisations should provide financial support for the procurement of multimedia facilities in schools that would enhance the attainment of educational objectives.
5. The schools should be provided with generators to avoid electrical power supply interruption during the use of multimedia facilities in the teaching and learning process.
6. Supportive infrastructures such as laboratories, classrooms should be provided to schools to enhance the adoption and application of multimedia in teaching and learning process.

## XII. Future Work

In the future, the researchers will use an experimental research design to investigate the effectiveness of multimedia technologies as modern pedagogical tools for strategic improvement on teaching and learning of Computer Science in the establishment of the perceived benefits of multimedia recorded through the use of descriptive design.

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