IMPACT OF MULTIMEDIA TECHNOLOGY ON COMPUTER SCIENCE STUDENTS' ACHIEVEMENT IN SECONDARY SCHOOLS IN ILORIN, NIGERIA

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Abstract

This study was conducted to investigate the impact of multimedia technology on computer science students' achievement in senior secondary schools in Ilorin, Kwara State Nigeria. One hundred and two (102) SSII students were involved in this study. The design of this study was a quasi-experimental research design as there was no randomization of subjects into classes. Intact classes were used. Three research questions and three research hypotheses were answered. Research questions were answered using mean and standard deviation. Analysis of Covariance (ANCOVA) was used to test the hypotheses at a 0.05 level of significance, results from this study revealed that students who were taught Computer science using multimedia instructional strategies achieved better than those taught without instructional strategies. The study equally revealed no significant difference in the mean achievement scores of male and female students. Overall, multimedia technology had a positive impact on the computer science students' academic achievement. The study concluded that the use of multimedia technology has potential to raise the academic performance of computer science students in secondary schools in Ilorin, Nigeria. The study also recommended that teachers use multimedia technology in their instruction to help computer science students reach their academic potential. Implications for theory and practice are discussed.

Keywords: multimedia, students, computer science and technology, achievement, gender

Introduction

The computer is a supplement, not a replacement for anything. The pedagogical applications of computers demand that both teachers and students acquire the knowledge and attitudes necessary for efficient use of technological tools. In addition to facilitating literacy, technology tools also help people learn to program, learn about specific topics, and learn independently at home. This calls for the adoption of novel techniques including modeling, simulation, database use, guided discovery, and closed-word exploration, among others. The consequences of changes in teaching methodology, instructional materials, teacher roles, and curriculum context are evident and unavoidable (Tella, Tella, Toyobo, Adika, & Adeyinka, 2010). The benefits of using technology tools in pedagogy include boosting motivation, assisting with the recall of prior knowledge, offering novel instructional stimuli, eliciting a response from the learner, providing systematic and consistent feedback, facilitating appropriate practice, sequencing learning in an effective way, and providing a trustworthy source of information for improved learning. Teachers that employ this kind of training will be able to instill in their students a positive attitude toward using technology in all facets of their lives (Tella, Tella, Toyobo, Adika & Adeyinka, 2010).

The use of multimedia learning technology (MLT) has created a technologically oriented learning environment where students can independently explore issues, work in groups, and actively participate in finding answers. The combination of text, data, images, graphics, audio, video, and animation in digital form is made possible by the advanced technology known as multimedia. The mainstreaming of technical media within of what is referred to as "Multimedia" was a trend that gave rise to several uses of computer technology.

The concept for this technology began to take shape with the advent of sound cards, then compact discs, the use of digital cameras, and eventually, video, which elevated the computer to the status of an essential teaching tool. Multimedia has become a unique field in recent years. Models, study materials, and simulations that are media-rich and incorporate animated and still images, audio files, and videos in a well-organized design are necessary to effectively promote the learning of new beliefs. Multimedia, according to Guan, Song, and Li (2018), combines several media types, such as text (alphabetic or numeric), symbols, graphics, photos, audio, video, and animations, typically with the help of technology, in order to improve comprehension or memorization.

The interactive nature of multimedia has made it feasible to improve the traditional "chalk-and-talk" teaching method. It enhances spoken teaching with the use of static and animated images as a sort of visualization technology for better expression and comprehension (Alemdag and Cagiltay, 2018; Chen and Liu, 2008). Multimedia technology refers to the hardware and software utilized for developing and running multimedia applications (Kapi; Osman; Ramli & Taib, 2017; Olakulehin, 2007) emphasized that the pedagogic use of ICTs entails effective learning using computers and other information technology tools. These tools serve as learning aids and complement teachers, instructors, and facilitators rather than replacing them. Agarwal and Malik (2012) analyzed the value of multimedia in several facets of the present educational system. It was found through their research, which discussed various methods used by different colleges, that multimedia had more potential to influence multimodal, lifelong education, and flexibility for varied learners. Studying the literatures made it abundantly evident how effective multimedia is as a flexible tool for creating personalized learning environments to address a range of behavioral issues including confidence-building and stress management. It was demonstrated unequivocally that multimedia, when utilized properly, may support the development of the intended users' psychomotor skills and visual processing. Another study used an extension of the Unified Theory of Acceptance and Usage of Technology (UTAUT2) as a framework to investigate the variables that influenced instructors' performance and continued usage of multimedia-enhanced content. The teachers were given 2000 samples by Joel, Betty, and Mussa (2016), and 1137 of those samples were gathered and put to the test using regression analysis. Except for performance expectancy, all other factors showed statistically significant effects on teachers' acceptance and usage of the generated content, according to the data acquired. The government and other stakeholders are expected to implement the study's conclusions to encourage the adoption and use of the created framework in schools.

In their study, Davies and Eyo (2016) examined the use of multimedia in political science instruction and learning at the University of Uyo in Nigeria's Akwa Ibom State. A questionnaire named "Use of Multimedia in Teaching and Learning of Political Science in University of Uyo" (UMTLPSUU) was used as the research method for this survey study. The data was examined using percentages and independent T-tests. According to the study's data, 62 (66.2%), 76 (81.7%), and 69 (74.2%) of the respondents, respectively, confirmed that instructional multimedia was available on CDs, a projector, computers, and sound systems at their respective faculties. The survey also showed that most respondents were unaware of the precise number of computer sets that are accessible in the department. It was also revealed that their section possesses one to five recording devices available. In accordance with the majority of responses, projectors, as well as computers are considered "not very often" used in the department for instruction. Furthermore, it became apparent that the department's computer systems, sound setups, simulation software, and projector usage were insufficient. This suggests that the department's limited selection of instructional multimedia has little to no impact on students' involvement in classroom activities and academic success.

Umar, Ossom, and Egbita (2020) in Minna, Niger State, investigated the effects of multimedia teaching techniques on students' success and retention in fundamental science and technology. The sample for the study consisted of 102 JSSII students. There was no randomization of subjects into courses, making the study's design a quasi-experimental one. Intact classes were utilized. The

study was guided by four research questions and four hypotheses. Mean and standard deviation was utilized to analyze data to respond to research questions, and analysis of covariance (ANCOVA) was employed to test hypotheses at the 0.05 level of significance. The study's findings showed that adopting multimedia instructional tactics increased students' achievement and retention compared to teaching without such strategies. Additionally, students who learned fundamental science and technology while utilizing multimedia teaching methodologies as a tool had greater achievement and retention rates than students who learned the same subjects without the use of multimedia. According to the survey, there was no discernible difference between male and female students' mean retention and achievement ratings. One of the suggestions provided is for instructors to focus more on using multimedia education as a tool rather than a lecture style for successful teaching and learning of fundamental science and technology.

Academic achievement is a significant aspect that has been linked to instructional strategies. Achieving something is the act of doing something successfully, especially when effort and talent are used. So, according to Abdulrahman, Bello, and Bauchi (2019), academic achievement refers to the attainment of academic goals, the educational results of students, or rather the degree to which a student, a teacher, or an instructor has attained the specified educational objectives. Achievement, according to Falode, Sobowale, Saliu, Usman, and Falode (2016), is defined as observable modifications in students' academic behavior brought on by exposure to a certain topic. Adeyemi (2008) defined achievement as a student's current academic position. It relates to the completion of the objective or goals. The goal of assessing an achievement is to assist the instructor and students to determine the level of success gained in understanding a particular idea. The ability to retain knowledge and skills can also be tested using this method. It is equally suitable for assessing the effectiveness of instruction.

Many specialists in the field of education have noted gender disparities in how people react to multimedia technologies. The academic achievement of students, particularly in science disciplines, is significantly influenced by a number of factors, one of which is gender, as indicated in the literature. Adigun, Onihunwa, Irunokhai, Sada, and Adesina (2015) defined gender as the array of physical, biological, mental, and behavioral traits that are specific to and distinguish the feminine and masculine (female and male) populations. Gender disparities in adolescent smartphone usage habits as multimedia tools were the subject of a research conducted by Taywade and Khubalkar (2019). The study investigated how teenagers used their smartphones differently depending on their gender, and it also tried to investigate why smartphone addiction could be rising among both sexes. 300 teenagers made up the study's sample, and the results show that male and female teenagers use smartphones in dramatically different ways. In addition, as women use cellphones substantially more often than men, this study aims to investigate the reasons behind problematic smartphone usage among women and potential remedies.

In a report intended to examine the effects multimedia technologies have on the efficiency and improvement of educating young children in Jordanian primary schools. A program was created by Sawsan, Izzat, Mohammed, and Fatima (2012) to assess students' understanding of the fundamental concepts and skills in mathematics. Considering the distribution of their own courses, two groups were chosen from a nearby school. While the second groups were taught using the standard traditional style of instruction, the first group was taught the topic in basic mathematics using a customized software. The outcomes demonstrated that, especially when cartoon characters are included, adopting enhanced multimedia teaching techniques might be successful in grabbing the kids' interest at this age. When compared to the distribution of gender, there were no appreciable differences in knowledge, abilities, or information retention. Their future work will center on conducting a field study with students to evaluate the success of implementing an interactive multimedia system with larger experimental groups and applying different game applications to various subjects of area of knowledge in order to produce more generalized results and to research the necessary drawbacks of using these educational games on students.

Statement of the Problem

To close the gap between industrialized and developing countries, it is vital to raise the quality of education, and multimedia teaching is seen as a key tool for this. The combination of text, data, images, graphics, music, video, and animation in digital form is made possible by the sophisticated technology known as multimedia. Despite the advantages of multimedia in education, its use is still limited in secondary schools because teachers and school administration have not yet embraced and integrated multimedia into instructional activities. Instead, teachers continue to insist on using the traditional method of instruction, which is not based on sense experience and does not broaden students' experience. However, the mere presence of multimedia in a classroom won't lead to significant improvements. Teachers play a big part in how multimedia teaching is implemented in the classroom. The majority of kids may not fully benefit from all of the potential advantages of multimedia on their own if teachers are not involved. Teachers must actively participate in the usage of multimedia tools. To encourage students' critical thinking and creativity, they must get training in the usage of multimedia and how to incorporate it into classroom activities. They must also have the ability to support and motivate pupils by giving them ownership over their own education. It was discovered that many recent grads lacked creativity, communication skills, analytical and critical thinking, and problem-solving abilities (Teo and Wong, 2000; Tan, 2000). To help students do better in computer science, particularly in national examinations, computer science teachers have looked for improved ways to convey the material. Students generally perform better and pay more attention in class when there is instruction happening on, according to the majority of schools that have accepted the use of multimedia technology as a teaching strategy. In light of this, the purpose of this study was to determine whether there are any significant differences between the multimedia method of teaching and the traditional method of teaching computer science in secondary schools. It also sought to determine whether there are any significant differences between male and female students who were taught using the multimedia method of teaching.

Research Questions

The study was guided by the following research questions:

1. What is the impact of multimedia instructional strategies on students' achievement in computer science?
2. What is the achievement score of male and female students' taught computer science using multimedia instructional strategies?
3. What is the interaction effect between gender and method on students' achievement in computer science?

Research Hypothesis

The following null hypotheses were tested at 0.05 level of significance

1. **HO_1**: There is no significant difference in the achievement scores of students taught computer science using multimedia and those taught using conventional teaching methods.
2. **HO_2**: There is no significant difference in the achievement scores of male and female students taught computer science using multimedia instructional strategies
3. **HO_3**: There is no significant interaction effect between gender and method on students' achievement in computer science

Methodology

For this investigation, a quasi-experimental approach was employed. The study was conducted in the Nigerian city of Ilorin, Kwara State. All second-year senior high school pupils in Ilorin, Kwara State, made up the study's population. 102 SSS II students from two senior high schools in Ilorin, Kwara State, were chosen using stratified random sampling. The researcher created and employed the Computer Science Achievement Test (CSAT) and two other tools for the aim of gathering data. Face validation was applied to the CSAT. Two specialists from the Computer Science Education Department at the Kwara State College of Education in Ilorin performed the face validity. In the Government Secondary School in Chanchaga, which was not one of the chosen institutions, a trial test was done to evaluate the validity of the test instrument (CSAT). The 40-item list was examined on a sample of forty (40) second-year students at the

school. The reliability coefficient for the test was calculated using the Kuder-Richardson 21 (K-R 21) method and was found to be 0.81. Using Pearson's Product Correlation Coefficient, the results of the two tests' administrations were correlated. The calculated coefficient of stability was 0.96. The statistical software for the social sciences (SPSS) was used to analyze the study's data. In order to analyze the data and provide answers to the study objectives, pre-test, post-test, and retention tests (lead post-test) were administered. To compare the impact of conventional instruction versus multimedia instructional methodologies on students' achievement and retention in fundamental science and technology, the mean gains of each treatment group's pre-test and post-test assessments were computed. The hypotheses were tested at a significance level of 0.05 using an analysis of covariance (ANCOVA).

Results

Research Question 1

What is the impact of the use of multimedia on students' achievement in computer science?

Table 1 : Achievement scores of students based on treatment

	N	Minimum	Maximum	Mean	Std. Deviation
Experimental Group	26	10	23	17.5769	4.73433
Control Group	25	6	26	14.1200	5.21472

Table 1 demonstrates that students in the experimental group who received multimedia instruction scored better on accomplishment (17.58) than their peers in the control group who received traditional instruction (14.12). The outcome so demonstrates that the pupils' academic success was greatly impacted by the usage of multimedia.

Research Question Two: *What is the achievement score of male and female students taught computer science using multimedia instructional strategies?*

Table 2: Achievement score of male and female students taught using multimedia (MPCSI)

	N	Minimum	Maximum	Mean	Std. Deviation
Male	10	10	24	16.2000	5.30827
Female	16	10	23	18.4375	4.28904

Table 2 demonstrates that although female students who were additionally exposed to MPCSI received a mean score of 18.4375 and a standard deviation of 4.28904, the mean scores for male students exposed to MPCSI were 16.20 and 5.30827, respectively. According to the findings, female students who received the same instruction in computer science as male students fared better academically.

Research Question Three: *What is the interactive effect of method and gender on students' achievement in computer science?*

Table 3: The interactive effect of method and gender on students' achievement in computer science

	Male	Female	Mean Difference (Method)
Experimental (MPCSI)	16.2000	18.4375	2.2375
Control (CTM)	15.5714	12.2727	3.2987
Mean Difference (Gender)	0.6286	6.1648	

Table 3 demonstrates that while both male and female students exposed to MPCSI received mean scores of 16.20 and 18.44, respectively, with a mean difference of 2.24. Male and female students in the control group, who were taught using the conventional method, achieved averages of 15.57 and 12.27, respectively, with a mean difference of 3.30. Those exposed to the Multimedia Package for Computer Studies Instruction outperformed those exposed to the Conventional Teaching Method, according to comparisons between the two findings from methods (MPCSI and CTM). Additionally, the girls in the experimental group had a surprising degree of comprehension above and beyond the males. The experimental group's male students received a mean score of 16.20, while the control group's male students received a mean score of 15.57. Their mean differences added up to 0.63, indicating that the experimental group's male students performed better than the control group's male students. When the mean differences of the females in the experimental group and the control group were compared, the experimental group's females had a mean of 18.44, while the control group's females had a mean of 12.27, with their mean differences adding up to 6.17. The females' increase in achievement was therefore more pronounced and greater than that of the males.

Testing of Null Hypotheses

Hypotheses One: *There is no significant difference in the achievement scores of students taught computer using multimedia and those taught using conventional teaching methods.*

Table 4: ANCOVA results based on method (Treatment vs control)

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	194.321[a]	2	97.160	16.027	.000	.604
Intercept	67.561	1	67.561	11.145	.003	.347
Pretest	159.279	1	159.279	26.274	.000	.556
Group	45.427	1	45.427	7.494	.012	.263
Error	127.304	21	6.062			
Total	7567.000	24				
Corrected Total	321.625	23				
a. R Squared = .604 (Adjusted R Squared = .566)						

Table 4 above indicates that the computed F value was 7.494 with a significance level of 0.012. When F is less significant than the alpha threshold (0.05), it is considered significant. Therefore, we accept the alternate hypothesis and reject the first. The mean accomplishment scores of students who were taught utilizing multimedia compared favorably to those who were taught using

traditional teaching techniques.

Hypotheses two: *There is no significant difference in the achievement on male and female students taught computer using multimedia.*

Table 5: ANCOVA results showing the impact of gender on the achievement scores of the students taught computer using multimedia.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	178.674[a]	2	89.337	12.987	.000
Intercept	70.400	1	70.400	10.234	.006
Pretest	112.259	1	112.259	16.319	.001
Gender	75.462	1	75.462	10.970	.004
Error	110.063	16	6.879		
Total	7533.000	19			
Corrected Total	288.737	18			
a. R Squared = .619 (Adjusted R Squared = .571)					

a. R Squared = .619 (Adjusted R Squared = .571)With a significance level of 0.004, Table 5 above displays the computed F value as 10.970. F is significant since its alpha level significance (0.05) is smaller than it. We accept the alternative hypothesis as a result of rejecting the second. Consequently, as shown in table 2, there is a substantial difference in the accomplishment scores of male and female students who were taught using multimedia. Female students who were exposed to the usage of multimedia performed better than their male counterparts. Hypotheses Three: *There is no significant interaction between gender and method on students' mean achievement in computer science*

Table 6: ANCOVA results showing the interaction effects of gender and method on the achievement of students in computer science

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	440.018[a]	4	110.004	43.559	.000
Intercept	15.076	1	15.076	5.970	.024
Pretest	315.684	1	315.684	125.004	.000
Group	37.345	1	37.345	14.788	.001
Gender	4.102	1	4.102	1.624	.218
Group * Gender	26.982	1	26.982	10.684	.004
Error	47.982	19	2.525		
Total	8264.000	24			
Corrected Total	488.000	23			
a. R Squared = .902 (Adjusted R Squared = .881)					

Table 6 above indicates that the calculated F value as 10.664 with a significance of 0.004. The significance of F is greater than the alpha level (0.05), which means that it is significant. Therefore, hypothesis three is rejected and the alternative hypothesis is accepted. Hence, there is a significant interaction between gender and method on students' mean achievement in computer science.

The interaction effects between gender and method on students' achievement in computer education was examined using hypothesis three; the result of the analysis of covariance (ANCOVA) showed significant interaction between gender and method on students mean achievement in computer science the male students exposed to MPCSI obtained a mean score of 16.20, while the female students also exposed to MPCSI obtained a mean score of 18.44, they have a mean difference of 2.24, From the control group, those exposed to the Conventional Teaching Method (CTM), the male students obtained a mean of 15.57 and the female students obtained a mean of 12.27, with a mean difference of 3.30, Comparing the two results from method (MPCSI and CTM), it is observed that those exposed to multimedia Package for Computer Studies Instruction achieved better than those exposed to the Conventional Teaching Method. The females from the experimental group also showed a remarkable measure of understanding more than the males. Their mean differences in gender is also evident, the male students from the experimental group obtained a mean score of 16.20 while their male counterparts in the control group obtained a mean score of 15.57 with their mean difference summing up to 0.63, showing that the males exposed to MPCSI achieved better than the males exposed to CTM. Comparing the mean difference of the females as well from the experimental group and control, the females from the experimental had a mean of 18.44 while the females from the control group had a mean of 12.27 with their mean difference summing up to 6.17, the females increase in achievement was evident and also more than that of the males.

Discussion

Finding from the study revealed that there was significant difference in the achievement of students taught computer science using multimedia and those taught without it. The finding from the study revealed that the use of multimedia favoured the students in the experimental groups, the students achieved very much better than those taught conventionally. Therefore, the result agrees with the findings of Ellaisamy (2007) and Garnett, Hackling and Oliver (2009) that provided empirical evidence showing the efficacy of multimedia package in promoting meaningful learning and understanding of concepts, thereby enhancing students' performance. Cockerill, Comeau, Lee, and Vinayak (2015) expressed their view that multimedia package resources motivate learners leading to the production of richer learning outcome and thereby create opportunities for the achievement of educational goals.

The findings from the study also revealed that there is a significant difference between the achievement scores of male and female students taught using Multimedia as shown in table 2, the female students exposed to the use of Multimedia achieved higher than their male counterparts. This finding is in agreement with Rabiu, Muhammed, Umaru and Ahmed (2016) who examined Impact of Mobile Phone Usage as a multimedia instructional package on Academic Performance among Secondary School Students in Taraba State, Nigeria. And the finding disagreed with the views of Falode (2014) and Yisa (2014) that gender is not a significant factor in the performance of students in science especially in biology and physics.

Conclusion

The findings of this study indicate that the use of multimedia technology in measuring student performance by focusing their attention on the topic of "Computer Science" has been beneficial. The use of multimedia technology in the classroom helped students learn more effectively, enjoyed and appealing learning experiences, and had a better and more complete understanding of the computer science concepts being taught to them. The students favored using multimedia technology to educate rather than the traditional way, according to the mean and standard deviation

associated with their questionnaire replies. The outcome of the descriptive statistics revealed that the multimedia technique had a higher mean score than the traditional method. The outcome of the ANCOVA analysis also revealed a significant difference between the mean scores of the two instructional approaches. Therefore, it can be said that the use of multimedia technology in the classroom has improved students' performance in computer science.

Recommendations

1. This study's findings demonstrate that multimedia is very successful and has a favorable impact on students' academic performance. As a consequence, multimedia tools and equipment should be purchased and disseminated to all junior secondary schools in Kwara State.
2. Stakeholders should emphasize the use of computers as pedagogical instruments in the classroom and promote the use of multimedia in teaching other theoretical curricula.
3. Providing computer science teachers with educational workshops on how to incorporate multimedia into their lesson plans, provided that these workshops are accessible throughout the academic year.
4. This study may be replicated and improved by computer science academics if they conducted it with a bigger sample size and at different educational levels within the country's educational system.

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