Original Article

Performance of Students in Public and Private Universities Taught Computer Science and Mathematics Courses Using Blended Learning Approach: A Comparative Study

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Abstract

The 21st century is characterized by the Fourth Industrial Revolution, with Computer Science at its core. As industrialization relies heavily on computer technology, the study of Computer Science has become central to modern education, particularly in universities. However, the integration of mathematics into Computer Science curricula has sparked debates among scholars. While some experts argue that Computer Science is inherently mathematical, others contend that its mathematical components are minimal, leading to the transformation of traditional mathematics courses like Numerical Methods and Discrete Mathematics into computer-specific versions. This study investigates the relationship between mathematics and Computer Science courses, examining whether differences exist in student performance based on the instructional approach (Blended Learning) and the type of university (public or private). The study involved 674 second-year Computer Science students from Enugu State, using the Mathematics Method Achievement Test (MMAT) and Computer Programming Achievement Test (CPAT) as data collection instruments. Results revealed no significant correlation between student achievements in Mathematics and Computer Science courses, although Blended Learning enhanced performance in both areas. Additionally, students from private universities outperformed their public university counterparts in Computer Science courses. The study recommends that the National Universities Commission (NUC) organize workshops to promote Blended Learning and reconsider the emphasis on mathematics in Computer Science curricula.

Keywords: Fourth industrial revolution, computer science, mathematics integration, blended learning approach, student achievement, curriculum development

Introduction

Education is the transmission of culture, value and knowledge from one generation to another. Education is an instrument for effective national development. Any nation that wants to develop must develop their educational system. Ayo (2021) posits that education is the process by which individuals acquire the knowledge, skills, and attitude required to become productive members of society. In Nigeria, there are three tiers of education which are basic education, secondary and

tertiary educational levels. Tertiary education is the type of education given after secondary education. There are four types of tertiary education institutions in Nigeria which are University education, polytechnic education, monotechnic education and college of education. Among the four tertiary education institutions, the university education remains the highest education level. This is because all the staff that oversees the running of all these tertiary education attends university education. There is no way that a staff in all these four tertiary education institutions can attain their highest level without attending university education.

The University Education institutions in Nigeria are supervised and licensed by the National Universities Commission (NUC). In Nigeria there are 264 universities, which comprises of 63 state government owned universities, 147 private universities and 52 federal universities (NUC, 2024). Out of 264 universities in Nigeria, 78 universities are offering Computer Science and 76 are offering Computer Science Education (Edna, 2024). The number of students studying computer science in Nigerian universities are on the increase. According to Edna (2024), the exponential rise in technology and the fact that computer science is the foundation of industrial revolutions is the reason for the continuous increase in the number of people studying computer science. From Princeton review, Computer Science is the most sought after course of study by students in Nigerian Universities. According to Oda (2020), Computer Science offers students automatic employment in the world of technology especially in Nigeria where the high rate of unemployment is high. According to Oda (2020), a country cannot claim to be an ICT complainant until its citizens are taught the fundamentals of computers.

Computers power the world, and any country that does not adopt ICT is viewed as being in the past. According to Anderson (2017), the astounding advancements in computer technology have not only had a significant impact on society as a whole but have also brought about important shifts in education. Graduates of the four-year bachelor's degree program in computer science can pursue jobs as network and system analysts, computer scientists, programmers, and so on. In order to be considered for admission to the course, candidates must have earned five (5) credits or more in WAEC/NECO with subjects like mathematics, English language, economics, physics, and one science subject and they must also have taken English, mathematics, physics, and one other science subject in the annual UTME (JAMB, 2024). In line with the guideline with JAMB (2024), NUC (2024) made Mathematics courses compulsory for Computer Science students. This is because they thought mathematics was essential to computer science and that it was vital to the creation and progress of technology. According to Adelayo (2020), there is a close connection between computer science and mathematics. This is so because computer systems, data structures, and algorithms all rest on the foundation of mathematics.

Computer scientists cannot develop and construct effective and efficient software or systems unless they have a solid background in mathematics. Computer uses algorithms, which are sets of instructions, to solve problems and complete tasks. They are the brains behind every Computer program and are employed in operations like data sorting, information searches, and the computation of intricate mathematical equations. Computer scientists need to have a strong grasp of mathematical ideas like combinatory, logic, probability, and data structures in order to develop

efficient algorithms. The study of artificial intelligence and machine learning is another area in computer science where mathematics is crucial. As a subset of artificial intelligence, machine learning entails using algorithms to examine and learn from data in order to forecast or make judgments. Proficiency in mathematical topics, including linear algebra, calculus, and statistics, is necessary for this task. For example, a computer scientist needs to have a thorough understanding of statistical analysis and probability theory in order to develop an algorithm that can anticipate stock prices with accuracy. Arithmetic is crucial to computer science for the development and manipulation of data structures in addition to its used in algorithms and machine learning. Data in a computer is saved and arranged using what are known as data structures. Data structures come in various varieties and serve a variety of functions. A data structure's mathematical features determine how effective and efficient it is. Data structures that are frequently used in computer science include trees and graphs. These structures are derived from mathematical ideas like tree theory and graph theory or the purpose of creating computer graphics and visualization, mathematics is also crucial in computer science.

Algorithms are used in computer graphics to produce visuals and animations that are seen on a screen. This calls for a solid grasp of ideas in linear algebra, geometry, and 3D modeling. For example, a computer scientist needs to have a strong grasp of geometry and spatial relationships in order to generate a realistic 3D model of a building. However, a survey done by Obi (2023) showed that Computer Science students preferred that the mathematical courses are removed on grounds that the knowledge of mathematics has nothing to do with Computer Science. Obi (2023) and Musa (2022) in their separate studies concluded there was no relationship between the mathematical courses added to the Computer Science students to study and their Computer Science as their discipline. This finding was witnessed at the Computer Science CCMAS of Madonna University, where 4 out of the 8 mathematical courses that the students offer were removed. This analog may be the reason why the Computer Science experts converted two mathematics courses into Computer Science such as Numerical Method which was converted from MTH 251 to CSC 251 and Discrete Mathematics which was converted from MTH 252 to CSC 252. Musa (2022) had advocated on the need for the Computer Science policy makers to reduce Mathematics courses for Computer Science students insisting that the current technology does not necessary need Computer Scientist to become a mathematician.

On the other hand, Obi (2023) revealed that the computer science students have poor perception about Mathematics courses which resulted to their constant poor performances in those courses. Nwankwo and Obiakor (2020) noted that students' performance in computer science was low in both national and state examinations. The assertions of Eze (2022) and Obi (2023) revealed that Computer Science students performed poorly in both Mathematics and Computer Science courses, which means that their poor performance in Mathematics courses may not be attributed to their poor knowledge of Mathematics but can be attributed to other factors since that they also perform poorly in Computer Science. There is need to determine if there is a relationship between the students' performances in Mathematics and Computer Science courses. This is in order to ascertain if their poor performances in Mathematics courses is as a result of poor knowledge of Mathematics

which is in line with Obi (2023)'s assertion or to other factors. Zemke (2012) revealed that mathematics and Computer Science students had positive attitude in pre-calculus algebra when taught using blended e-learning.

In an attempt to discover the root cause of students' poor performances in Computer Science courses, experts like Oda (2020) have asserted that, if the computer science professor employs an incorrect approach when giving the computer science course, even after all the issues contributing to the students' low performance are fixed. According to Olarewaju (2016), students' poor performance in computer science is mostly caused by lecturers' contempt for the method that is activity-oriented. This is the outcome of how the instructors conducted themselves which renders them experts in every area of computer science. Oda (2020) found that instructors in computer science favoured the use of traditional methods. One approach that many experts are calling for, particularly in this technology age, is computer-related pedagogy (Olarewaju, 2016). The Blended Learning Approach is one of the pedagogies associated to computers. The blended learning approach was chosen because, as stated by Osguthorpe and Graham (2023), blends traditional in-person instruction with technology-mediated training. The blended learning approach is a pedagogy designed for usage in the modern period of industrial revolutions. Blended learning involves combining several event-based learning activities (Jonathan, 2019). Jonathan goes on to describe these activities as in-person classroom instruction, live online instruction, and self-paced learning. In a self-paced blended learning approach, the learner completes the online course at their own convenience, regardless of time or location. In a face-to-face classroom using blended learning, the lecturer can put materials online for students to access at any time and from any location, allowing them to learn at their own pace and when they need the skills. The teacher will still physically teach the students in the classroom.

However, as interesting as Blended Learning Approach may sound, science educators have contradictory findings. According to Garrison and Kanuka's (2020), analysis of the blended learning approach's revolutionary potential, there has been a rise in student satisfaction, enhanced interest development, and course accomplishment rates. Morris and Lim's (2019) study revealed that the use of technology in blended learning does not affect students' learning outcomes. Morris & Lim's (2019) and Kanuka's (2020) conclusions run counter to one another. This is due to the fact that fostering independent learners through the use of information and communication technology (ICT) is one of the difficulties in teaching mathematics and computer science courses, even while retaining students' active participation in the process and raising their academic performance. It is thought that the blended learning approach can address the low achievement levels of students in computer science and mathematics courses. This prompted the researchers to embark on this study with the aim of determining if the low performance of Computer Science students in Mathematics courses is caused by the lecturers' methodology or by other factors. Additionally, the researchers were able to ascertain whether there is a difference in the computer science and mathematics course performance of students attending private or public universities by utilizing the Blended Learning Approach. This is due to the fact that Aniowo (2022) claimed that the performances of private and public students differed. She claimed that students at public

universities outperformed those at private institutions, however Chikere-Anike (2021) found no distinction in the academic achievement of students at private and public universities.

Purpose of the Study

The purpose of the study was to determine performance of students in public and private universities taught computer science and mathematics courses using blended learning approach as a comparative study. Specifically, the study tends to determine the;

1. Mean achievement scores of university students taught Computer Science and Mathematics Courses using Blended Learning Approach and those taught using the conventional method;
2. Mean achievement scores of public and private university students taught Computer Science and Mathematics Courses using Blended Learning Approach; and
3. Relationship between Mean achievement scores of university students taught Computer Science and Mathematics Courses using Blended Learning Approach.
4. Relative effect of Mathematics courses on students' achievement in Computer Science courses using Blended Learning Approach.

Research Questions

The following research questions guided the study

1. What are the mean achievement scores of university students taught Computer Science and Mathematics Courses using Blended Learning Approach and those taught using the conventional method?
2. What are mean achievement scores of public and private university students taught Computer Science and Mathematics Courses using Blended Learning Approach?
3. What is the correlation between mean achievement scores of university students taught Computer Science and Mathematics Courses using Blended Learning Approach?
4. What is the relative effect of Mathematics courses on students' achievement in Computer Science courses?

Research Hypotheses

The following research hypotheses which were tested at 0.05 levels of significance guided the study.

H0 1: There are no significant differences between the mean achievement scores of university students taught Computer Science and Mathematics Courses using Blended Learning Approach and those taught using the conventional method.

H0 2: There are no significant differences between the mean achievement scores of public and private university students taught Computer Science and Mathematics Courses using Blended Learning Approach.

H0 3: There are no significant interactions between university type and instructional method in Computer Science and Mathematics Courses.

H0 4: There is no relationship between mean achievement scores of university students taught Computer Science and Mathematics Courses using Blended Learning Approach

H0 5: There is no significant relative effect of Achievement in Mathematics courses on students' achievement in Computer Science courses.

Methodology

The design of this study was correlational research. The area of the study is Enugu state. Enugu state hosts 9 universities which comprise of 6 private universities and 3 public universities. The 6 private universities are Maduka University Ekwegbe, Godfrey Okoye University Thinkers-corner, Peace Land University Enugu, Coal City University, Enugu, Caritas University Amorji-Nike and Rennaince University, Ugbawka while the public universities are University of Nigeria Nsukka, Enugu State University of Science and Technology, Enugu and State University of Medical and Applied Sciences. The population for the study was 856 Computer Science Year 2 students in Enugu State. The population consists of 691 public university Computer Science students while 165 private University Computer Science Year 2 students in 7 out of 9 universities in Enugu state. Maduka University Ekwegbe and Peaceland University Enugu were excluded because they didn't have Computer Science department.

The sample size of the study was 674 Year 2 Computer Science students in Enugu State which comprises 591 students from public and 83 students from private universities. Four (4) out of the seven (7) universities were randomly selected for the study. Two Universities that were selected for the Experimental Group were Enugu State University of Science and Technology (ESUT) and Godfrey Okoye University, Enugu while the two Universities that were selected for the Control Group were University of Nigeria Nsukka and Coal City University, Enugu. Thus, intact classes were used.

Two Computer Science courses were selected for the study which were CSC 201 (Computer Programming I) and MTH 201 (Mathematics Method I). MTH 201 (Mathematics Method I) is a Mathematics Course that is taught at the Second Year while CSC 201 (Computer Programming I) is Computer Science course. These two courses were chosen because they are interrelated. In CSC 201, the students used the knowledge of MTH 201 in designing and implementing problems involving areas and volumes of shapes while MTH 201 centers on Differentiation and Integration, and their applications in determining areas and volumes of shapes of different shapes. Two instruments were used for the study's data collection, which were Mathematics Method Achievement Test (MMAT) and Computer Programming Achievement Test (CPAT). Hence, Mathematics Method Achievement Test (MMAT) was used to assess the students' achievement in MTH 201 while Computer Programming Achievement Test (CPAT) was used to assess the students' achievement in CSC 201. Both instruments had sections A and B. Section A consist of the respondent's personal data while section B of MMAT and CPAT contained 25 multiple choice items with 4marks for each item (that's a maximum score of 100 marks). Experts from Ebonyi State University (EBSU), located in Ebonyi State, evaluated both devices.

Three specialists validated the CPAT: one from the Department of Computer Science, one from the Department of Science Education's Computer Education option, one from the Department of Measurement and Evaluation, and one from the Department of Industrial Mathematics. Three more experts validated the MMAT: one from the Department of Industrial Mathematics, one from the Department of Science Education's Mathematics Education option, and one from the Department of Science Education's Measurement and Evaluation option. Based on their respective KR-20

coefficients of 0.74 and 0.71, it was determined that both studies were credible. The first researcher used a blended learning approach to teach two computer science lecturers handling CSS 201 at Godfrey Okoye University, Enugu, and the Enugu State University of Science and Technology (ESUT) for four (4) weeks. The researcher also observed them while they taught for a period of six weeks.

Additionally, over the course of six weeks, the researcher observed and trained the two computer science lecturers handling CSS 201 at the University of Nigeria Nsukka and Coal City University, Enugu, on how to use the conventional method. Meanwhile, the second and third researchers instructed the two math lecturers handling MTH 201 at the Enugu State University of Science and Technology (ESUT) and Godfrey Okoye University, Enugu on the use of Blended learning Approach for four (4) weeks and also monitored them as they teach in the period of six weeks. The researcher also taught the two Mathematics lecturers handling the MTH 201 of the University of Nigeria Nsukka and Coal City University, Enugu on the use of Conventional method for two (2) weeks and the researchers also monitored them as they teach in the period of six weeks. Those lecturers became the study's research assistants and they are the ones that taught their respective classes while the researchers monitored them indirectly. The experiment lasted for six (6) weeks. The research assistants administered the instruments as pretest (MMAT and CPAT) at the beginning of the treatment and posttest (MMAT and CPAT) at the end of the 6-weeks. The researchers marked and recorded the scores gotten from the pretest and posttest. The Statistical Package for Social Science (SPSS) was used to examine data collected from the pre- and post-tests (MMAT and CPAT). Multivariate analysis of covariance (MANCOVA) was used to test hypotheses 1, 2 and 3, hypothesis 4 was tested using Multiple Regression ANOVA, while r hypothesis 5 was tested using Multiple Regression at 0.05 levels of significance. The mean ($\bar{x}$) and standard deviation (s) were used to answer research questions 1 and 2. Pearson Product Moment Correlation Coefficient (r) was used to answer research question 3, and Regression was used to answer Research Question 4. The null hypothesis (H_0) was rejected if the significance of F (value of the test statistics) was less than 0.05, otherwise, Ho was not rejected at 0.05

Results

Question 1: *What are the mean achievement scores of university students taught Computer Science and Mathematics Courses using Blended Learning Approach and those taught using the conventional method?*

Table 1: *Students' Mean achievement Scores and Standard Deviations in Computer Science Courses*

Groups	Number	Students' Achievement in CSC 201				
		Pretest		Posttest		GAINED MEAN
		Mean ($\bar{x}$)	Standard Dev. (s)	Mean ($\bar{x}$)	Standard Dev. (s)	
Experimental	300	47.74	15.41	66.69	15.56	18.95
Control	343	44.95	16.00	55.31	16.03	10.36
Total	**643**					

Table 1 revealed that the mean achievement score of students in the Experimental group increased from 47.74 to 66.69 and a gained mean of 18.95 which is 39.69% increase in CSC 201 while the mean achievement score of students in the Control group increased from 44.95 at the pretest level with the standard deviation of 16.00 to 55.31 at the post-test level with the standard deviation of 16.03 and a gained mean of 10.36 which is 23.05% increase in CSC 201.

Table 2: *Students' Mean achievement Scores and Standard Deviations in Mathematics Courses*

Groups	Number	Students' Achievement in MTH 201				
		Pretest		Posttest		GAINED MEAN
		Mean ($\bar{x}$)	Standard Dev. (s)	Mean ($\bar{x}$)	Standard Dev. (s)	
Experimental	300	35.66	14.23	61.20	14.59	25.54
Control	343	39.16	13.51	52.22	13.69	13.06
Total	**643**					

Table 2 revealed that the mean achievement score of students in the Experimental group increased from 35.66 to 61.20 and a gained mean of 25.54 which is 71.62% increase in MTH 201 while the mean achievement score of students in the Control group increased from 39.16 at the pretest level with the standard deviation of 13.51 to 52.22 at the posttest level with the standard deviation of 13.69 and a gained mean of 13.06 which is 33.35% increase in MTH 201.

H0 1: There are no significant differences between the mean achievement scores of university students taught Computer Science and Mathematics Courses using Blended Learning Approach and those taught using the conventional method.

Table 3: *Multivariate analysis of covariance (MANCOVA) of the Students' Mean Achievement*

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Dec
Corrected Model	postMMAT	127005.660[a]	5	25401.132	11196.223	.000	
	postCPAT	168133.179[b]	5	33626.636	25244.636	.000	
Intercept	postMMAT	15059.333	1	15059.333	6637.800	.000	
	postCPAT	8929.686	1	8929.686	6703.813	.000	
preMMAT	postMMAT	122199.954	1	122199.954	53862.871	.000	
	postCPAT	1.784	1	1.784	1.340	.248	
preCPAT	postMMAT	2.790	1	2.790	1.230	.268	
	postCPAT	158463.017	1	158463.017	118963.465	.000	
GROUP	postMMAT	2824.216	1	2824.216	1244.848	.000	S
	postCPAT	560.263	1	560.263	420.608	.000	S
UNIVERSITY_TYPE	postMMAT	3.722	1	3.722	1.641	.201	NS
	postCPAT	165.078	1	165.078	123.930	.000	S
GROUP * UNIVERSITY_TYPE	postMMAT	277.235	1	277.235	122.199	.000	S
	postCPAT	145.609	1	145.609	109.313	.000	S
Error	postMMAT	1445.177	637	2.269			
	postCPAT	848.504	637	1.332			
Total	postMMAT	2454304.000	643				
	postCPAT	2701054.000	643				
Corrected Total	postMMAT	128450.837	642				
	postCPAT	168981.683	642				

a. R Squared = .889 (Adjusted R Squared = .889)
b. R Squared = .895 (Adjusted R Squared = .895)

Table 4: *Mean Scores and Standard Deviations of the Students in Mathematics Courses*

UNIVERSITY	Number	Students' Achievement in Mathematics Courses				
		Pretest		Posttest		GAINED MEAN
		Mean ($\bar{x}$)	Standard Dev. (s)	Mean ($\bar{x}$)	Standard Dev. (s)	
PUBLIC	246	34.53	14.28	66.12	15.54	31.59
PRIVATE	54	40.78	12.91	69.30	15.52	28.52
Total	**300**					

Table 4 revealed that the mean achievement score of students in the public universities increased from 34.53 at the pretest level with the standard deviation of 14.28 to 66.12 at the posttest level with the standard deviation of 15.54 and a gained mean of 31.59 in MTH 202 while the mean achievement score of students in the Private universities increased from 40.78 to 69.30 at the posttest level with the standard deviation of 15.52 and a gained mean of 28.52 in MTH 202.

Table 5: Mean Scores and Standard Deviations of the Students in Computer Science Courses

Groups	Number	Students' Achievement in Computer Science Courses				
		Pretest		Posttest		GAINED MEAN
		Mean ($\bar{x}$)	Standard Dev. (s)	Mean ($\bar{x}$)	Standard Dev. (s)	
PUBLIC	246	47.20	14.28	59.61	14.42	12.41
PRIVATE	54	50.22	12.91	68.41	13.26	18.19
Total	**300**					

Table 5 revealed that the mean achievement score of students in the public universities increased from 47.20 at the pretest level to 59.61 at the posttest level with a gained mean of 12.41 in CSC 202 while the mean achievement score of students in the Private universities increased from 50.22 to 68.41 at the posttest level with a gained mean of 18.19 in CSC 202.

H0 2: There are no significant differences between the mean achievement scores of students in public and private universities taught Computer Science and Mathematics Courses using Blended Learning Approach.

From the result of MANCOVA in Table 3, it was observed that UNIVERSITY TYPE gave F-value of 1.641 for MMAT which was not significant at .201 because .201 was greater than 0.05 while F-value of 123.930 for CPAT which was significant at .000 because .000 was less than 0.05. This means that there was no significant difference between the mean achievement scores of public and private university students taught Mathematics Courses using Blended Learning Approach and there was no significant difference between the mean achievement scores of public and private university students taught Computer Science Courses using Blended Learning Approach. This implied that the Computer Science students taught Computer Science courses in Private Universities performed and achieved better than their counterparts in Public Universities while for Mathematics courses, the Computer Science students taught Mathematics courses in Private Universities do not significantly performed and achieved better than their counterparts in Public Universities.

H0 3: There are no significant interactions between university type and instructional method in Computer Science and Mathematics Courses.

From the result of MANCOVA in Table 3, it was observed that GROUP * UNIVERSITY_TYPE gave F-values of 122.199 and 109.313 for MMAT and CPAT which was significant at .000 because .000 was less than 0.05. This means that there were significant interactions between university type and instructional method in Computer Science and Mathematics Courses. This implied Blended Learning Approach interacts with the type of Universities. For Mathematics Courses, the students in public universities, their students' achievements are boosted by 91.49% while their counterparts in private universities are boosted by 69.94%. For Computer Science courses, the students in public universities, their students' achievements are boosted by 26.29% while their counterparts in private universities are boosted by 36.22%.

What is the correlation between mean achievement scores of university students taught Computer Science and Mathematics Courses using Blended Learning Approach?

Table 6: *Pearson Correlation Coefficient of Students' achievement scores of university students taught Computer Science and Mathematics Courses*

Predictor	Criterion	N	Correlation Coefficient 'r'	Interpretation
Mathematics	Computer Science	643	-.048[a]	Negligible Negative Relationship

a. Predictors: (Constant), MMAT

b. Dependent Variable: CPAT

Table 6 above showed that the correlation coefficient of the Students' achievement scores of university students taught Computer Science and Mathematics Courses was -.048. The result

showed that there was a negligible negative relationship between Students' achievement scores of university students taught Computer Science and Mathematics Courses.

H0 4: There is no significant relationship between mean achievement scores of university students taught Computer Science and Mathematics Courses using Blended Learning Approach

Table 7: *Regression Analysis ANOVA of University Students taught Computer Science and Mathematics Courses*

Model		Sum of Squares	Df	Mean Square	F	Sig.	Dec.
1	Regression	382.771	1	382.771	1.508	.220[b]	NS
	Residual	162673.164	641	253.780			
	Total	163055.935	642				

a. Dependent Variable: CPAT
b. Predictors: (Constant), MMAT

From the result of Regression ANOVA in Table 7, it revealed that the Analysis of Variance (ANOVA) for the regression (predication) showed that F-ratio was 1.508 and was not significant at .220. Since .220 was greater than 0.05, the null hypothesis 4 was accepted as stated. Hence, the study concluded that there was no significant relationship between mean achievement scores of university students taught Computer Science and Mathematics Courses using Blended Learning Approach. This implied that the negligible negative relationship between Students' achievement scores of university students taught Computer Science and Mathematics Courses was not significant.

What is the relative effect of Mathematics courses on students' achievement in Computer Science courses?

Table 8: *Regression Model Summary of Students' Achievement in Mathematics courses on students' achievement in Computer Science courses*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change
1	-.048[a]	.002	.001	15.93048	.002

a. Predictors: (Constant), MMAT
b. Dependent Variable: CPAT

The result in Table 8 showed the multiple correlation coefficients R was -.048. The table also indicated that R^2 yielded .002, which was 2% of the variation in the Student' achievement in Computer Science Courses was attributable to the joint effect of their level in Mathematics Courses with a standard error of 15.93. The table further showed that for every adjustment that the students made in their achievement in Mathematics courses will result to 1% adjustment effect made on the students' achievement in Computer Science courses with the adjusted R^2 of .001.

H0 4: There is no significant relative effect of Achievement in Mathematics courses on students' achievement in Computer Science courses.

H0 5: There is no significant relative effect of Achievement in Mathematics courses on students' achievement in Computer Science courses.

Table 9: *Standardized and Unstandardized Regression Coefficients of Achievement in Mathematics courses on students' achievement in Computer Science courses*

Model		Unstandardized Coefficients		Standardized Coefficients			
		B	Std. Error	Beta	T	Sig.	Decision
1	(Constant)	57.486	2.299		25.004	.000	S
	MMAT	-.055	.045	-.048	-1.228	.220	NS

a. Dependent Variable: CPAT

Table 9 showed that the extent to which the Students' Achievement in Mathematics courses can predict the students' achievements in Computer Science courses is -.048% (Beta=-.048) is not significant with the t-value of -1.228 which is not significant at .220 since that .220 is greater than 0.005 level of significance. Also, Table 9 showed that the relative contribution of the Students' Achievement in Mathematics courses (MMAT) of any decrease of additional unit of 5.5% (Beta = -.055) to predict the increase in students' achievement in Computer Science courses by 57.486% (Beta=57.486) is significant with the t-value of 25.004 which is significant at .000 since that .000 is less than 0.05 level of significance. This means that there was significant relative effect of Computer Science Students' achievement in Mathematics courses on students' achievement in Computer Science courses.

Discussion of the Findings

The study found that students who received instruction in computer science and mathematics through a blended learning approach performed noticeably better than those who received instruction via a traditional manner. This result supports that of Garrison and Kanuka (2020), who found that a blended learning approach raises student achievement. This is because, as stated by Pigcon (2014), the Blended Learning Approach is a student-centered learning technique that enables students to engage with technology at their own pace and convenience, leading to faster and more effective learning. In this technological age, students interact with their phones always. This interaction boosts the students' achievement in both Mathematics and Computer Science courses, Hence, Computer Science and Mathematics lecturers should endeavour to use the Blended Learning Approach to teach their students Mathematics and Computer Science courses.

Also, the study discovered that Blended Leaning Approach significantly interacts with the students' achievements in Mathematics and Computer courses depending on the type of the university (public or private). According to Yemisi (2014), most private universities are always technological driven unlike the public universities. This may be the reason students taught with Blended Learning Approach performed better in Computer Science courses than their counterparts in public universities. The study found that the students in private universities use their phones to perform their programming assignments unlike their counterparts in the public universities. Also, the study found that the Blended Learning Approach boosts the students' achievement in Mathematics courses more for the public universities. This may be attributed to the rigid nature and stiff environment found in the public universities as revealed by Yemisi (2014). In public universities, students who fail Mathematics courses compound problems for themselves which makes it stiff and tedious for the students when compiling their results (Yemisi, 2014). This may

be the reason why the Computer Science students in public universities knowing how tedious it is for them to go to another department to get their Mathematics courses result may have propelled them to study harder using the Blended Learning Approach.

In addition, the study found that there Computer Science students in Private Universities achieved better than their counterparts in Public Universities taught Computer Science courses. This finding contradicts the finding of Aniowo (2022) who revealed that there was a variation in public and private students' performances. According to her, the students in the public universities perform better than their counterparts in private universities. However, due to the fact that the private universities are driven by the constant use of technology unlike their counterparts in public universities, it is possible that it propelled the students in private universities to achieve better than their counterparts in public universities in Computer Science courses. According to Yemisi (2014), most private universities are always technologically driven unlike the public universities and this may be the reason that prompted the Blended Learning Approach to boost students' performances in Computer Science courses more so than their peers at state colleges. The study did find, however, that there was no discernible difference in the achievement of Computer Science students in Mathematics courses between public and private universities. This finding is consistent with that of Chikere-Anike (2021), who also found no difference in the performance of students in either format.

Finally, although there was no significant correlation found in the study between the mean achievement scores of university students taught computer science and mathematics courses, there was a marginally significant relative effect found in the study between the achievement of computer science students in mathematics courses and their achievement in computer science courses. This relative effect was found to be -5.5%. This finding was in line with the assertions of Musa (2022) who revealed that there was a weak impact of mathematics courses on Computer Science. This assertion means that a student's performance in Computer Science courses cannot be determined by their performance in Mathematics. Based on this, a student needs a little knowledge of mathematics to excel in the study of computer science and not as accumulated as the experts of Computer Science in NUC (2012) planned the Computer Science curriculum. Musa (2022) advocated that Computer Science policymakers should reduce Mathematics courses for Computer Science students. The finding of this study partly agrees with the findings of Obi (2023) concluded there was no relationship between the mathematical courses added to the Computer Science students' study and their Computer Science as their discipline but partly disagrees with him, that the knowledge of mathematics has nothing to do with Computer Science.

Conclusion and Recommendations

This study highlighted that there was no relationship between the students' achievement in Mathematics and Computer Science courses but there was a weak predictor/impact of Computer Science students' Achievement in Mathematics courses on the students' achievement in Computer Science courses and that Blended Learning Approach enhanced both the Computer Science students' achievement in Mathematics and Computer Science courses. In addition, the study

revealed that Computer Science students in Private Universities achieved better than their counterparts in Public Universities taught Computer Science courses.

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

1. The National Universities Commission (NUC) should include a blended learning approach in computer science curricula.
2. The management of NUC should ensure that the standard of the administration and implementing of the Computer Science programme is uniform across all the universities both private and public especially in the area of using technology in implementing the Computer Science programme.
3. Through this journal, the NUC should organize conferences and workshops for Computer science lecturers on the use of the Blended Learning Approach
4. The management of the public universities should endeavour to interact with their private universities counterparts on implementing blended learning in the Computer Science courses in their universities.

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