



Effect of Computer-Assisted Instruction on Motivation in Geometry among NCE II Students in Sokoto State

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ABSTRACT

This study examines the effects of Computer-Assisted Instruction (CAI) on motivation in geometry among NCE II Mathematics students in Sokoto State Colleges of Education. The study population is 1,469 students, with a sample of 76 students (52 males and 24 females) from the College of Education, Maru, Zamfara State selected for the pilot study. The sample was divided into two groups: 38 students in the experimental group and 38 in the control group. Systematic random sampling was used to select students, who were then equally divided into the experimental and control groups. Data collection was conducted using the Students' Geometry Motivation Scale (SGMS), which has a validity and reliability coefficient of 0.86. Mean and standard deviation were used to answer the research questions. The results indicated a significant difference between the post-test achievements of students in the control and experimental groups. Additionally, the mean scores based on gender showed a significant difference in favor of female students in the experimental group. The findings suggest that Mathematics teachers may find CAI beneficial for making learning more concrete and improving their students' Mathematics achievement.

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INTRODUCTION

Motivation is the driving power that has become active. It is also said that motivation is the psychological aspect of the discussion that many details on behavior, with different individuals and at the same individual at time to time. Motivation is the process of inducing, inspiring and energizing people to work willingly with zeal, initiative (Mishra, & Koehler, 2006) confidence, satisfaction and an integrated manner to achieve desired goals. It is moral boosting of activity. It can also be seen as an act of stimulating someone or oneself to get a desired course of action or to push the right button to get a desired reaction. Motivation can be said to be a response from an action that is the goal. The motivation arises from within humans, but its appearance depends on the presence of other elements, such as its purpose,

and this purpose concerns the matter of necessity. With high motivation, students will be able to carry out their work diligently and persistently strive to achieve learning goals. Learning outcomes are influenced by intrinsic and extrinsic factors. One of the intrinsic factors is motivation. Piaget believed that motivation is the best to gain students' achievement (Hassan, Abdullah, & Ismail, 2023).

Poor motivation in Mathematics often leads to low achievement. For students to be motivated to learn in any discipline, they must participate in activities that are personally meaningful and worthwhile. In the case of traditional methods in Mathematics teaching, it is obvious that Mathematics concepts are usually being taught by using abstract examples and words. This way of teaching, which needs highly cognitive skills to assimilate the taught subjects,

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creates high pressure on the students leading them to lose their self-confidence and lower their use of capacities, hence achieving poorly due to low motivation.

Geometry is the practical branch of Mathematics that deals with the shapes and sizes of figures and their properties. The basic elements of geometry are points, lines, angles, surfaces and solids. This aspect of Mathematics helps students to develop the skills of visualization, critical thinking, problem solving, conjecturing, deductive reasoning and logical arguments. Therefore, geometry is a process that helps students to think reason and draw inferences. For instance, all architectural designs are done using the knowledge and skills acquired in geometry. Geometry, as a branch of Mathematics has a very significant place in education. Geometry covers a substantial part of the COE's Mathematics curriculum content and to perform optimally in geometry, the learner must have adequate grip and understanding of spatial skills used in manipulating objects in the 2 and 3 dimensions. Learning geometry prepares students for higher Mathematics courses and a variety of occupations requiring mathematical skills and problem-solving. It is used to develop skills that deal with understanding, manipulating, re-organizing, and interpreting relationships. Most of the items used in the environment are comprise from geometrical shapes and objects and utilizing these objects and shapes efficiently depends on understanding the relationship among them. Geometrical thoughts can also be used in solving problems (like painting, lining-wall among others), in defining the space and running our profession as well. Geometrical shapes and objects are a part of jobs and work. Making effective use of these objects depends on defining them and understanding the relationship between the object and its duty (Altun, 2004).

The application of knowledge of Geometry is important in construction industries and professions such as building, engineering, architecture, aviation industry and military studies which are major key sectors for every country including Nigeria to attain the peak of development (Altun, 2005). The benefits of

introducing Mathematics at all levels of the school system including colleges of Education (COE) are: to promote in students a deeper understanding of the physical space/geometric figures and shapes, strengthen the arithmetic Programme to provide geometric models in the arithmetic process, promote more fundamental development of the nature of measurement and measuring process, promote a closer relation and integration of geometric ideas into other parts of Mathematics and to encourage imaginative thinking in science and technology.

Despite the relevance of geometry in all the human endeavours, results of NCE 2 students repeatedly show the weaknesses of the students in passing any topic related to geometry. For example, the summary of results in 2021, 2022 and 2023 shows clearly the number of students that failed the course outnumbered the students that passed the course. This call for a serious concern from the department and college administrators to look critically about the root courses of the problem. After several investigations into the matter, it was identified that method of teaching is part of the problem that causes the students' failure in geometry in the college of education. Hence, this research was set to investigate whether using Computer Assisted Instruction (CAI) approach will reduce the failure of students in geometry.

Computer-Assisted Instruction (CAI) is defined as programmed instruction designed to enhance learners' comprehension and understanding of content through the use of computer and telecommunication devices. Findings from research conducted by Jackson (2023) revealed that CAI is a sure means of improving spatial skills in children and adults, but Nigerian teachers rarely use it for their instruction. Computer-Assisted Instruction can also be referred to as a self-learning technique usually offline/online, involving the interaction of students with programmed instructional materials (Ntibi & Orim, 2017).

Despite the relevance of ICT in education, teachers are still reluctant, ineffective, and unproductive in using CAI facilities to improve students' motivation and achievement especially

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in Mathematics. Colleges of Education trainers in developing countries like Nigeria still have a long way to go before will be able to take advantage of the opportunity provided by the 21st-century technology. For instance, Adomi (2010) has reported that 75% of teachers in Nigerian secondary schools have little or no experience and expertise regarding ICT education. The teachers' poor ICT skills account for their use of traditional teaching methods such as the lecture method. This approach will definitely promote the learning of mathematics in the College of Education.

STATEMENT OF THE PROBLEM

Base on the observation of the researcher that students are always confronted with low academic achievement in mathematics right from the secondary school level, allot were made to repeat their class because of failure in mathematics. Similarly, the National Examination of WAEC and NECO, the low achievements of students according the chief examiners report of 2019-2023 is presenting achievement level of less than 43% passes at credit level. This is not different from the statistics of results from the Sokoto educational resources center that indicate a passes of not more than 27%. Considering the significance of Mathematics in society, its foundational skills are utilised in our daily life. Despite extensive efforts by stakeholders including governments, researchers, and educational organizations to (Palculict, 2020) enhance Mathematics education through workshops and training programs, performance in the subject, particularly in Colleges of Education (COEs), remains low. Studies attribute this to ineffective instructional methods and inadequate subject knowledge among students, as evidenced by persistently poor results in institutions like Shehu Shagari College of Education, Sokoto (Isah, & Hamza, 2023). Concerns about the quality of Mathematics teaching and its impact on student motivation and achievement prompt calls for new approaches, such as investigating the potential of computer-assisted instructional methods to foster student-centered learning and improve outcomes in Mathematics.

Objectives of the Study

The specific objectives of the study include, to:

1. Determine the level of motivation of the COE students in Sokoto state before and after the treatment.
2. Determine the level of motivation of male and female students in the experimental and control groups.

Research Questions

The study will seek to answer the following questions:

1. What is the motivation mean score of the COE students in the experimental and control group?
2. What is the motivation mean score of male and female students in the experimental and control groups?

Empirically, allot of studies have shown that the use of instructional material in teaching and learning have improved students achievements level in virtually all fields of study Rogayan, Padrique and Costales (2021) investigated the effects of Computer-Assisted Instruction (CAI) on motivation and academic performance in social studies among students in a public secondary school in Zambales, Findings revealed that students motivational level of both the experimental and control group improved at the post test level. Silimilarly, (Padrique & Costales) concluded that there was a significant difference in the motivation and academic performance of students after the application of the CAI.

Palculict (2022), mentioned that computer-based interventions have a significant impact on student learning. Further research is recommended to explore the impact across grade levels. Omar, Ibahim, Akmanisah and Kadir (2023) investigated the effectiveness of computerized simulation with electronic circuits on students' motivation, achievement and cognitive load in Malaysia. It was concluded that electronic circuit simulation has a positive effect on students' motivation, achievement and cognitive load.

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Furthermore, Hassan, Abdullah and Ismail (2023) examined rethinking strategy on developing students' levels of geometric thinking in Sokoto state, Nigeria. Findings of the study revealed that the experimental group performed better than the control group. This indicated the effectiveness of utilising instructional material like CAI which improve students achievement and motivational effects that leads to high performance

The reviewed study examined rethinking strategy on developing students' levels of geometric thinking in Sokoto 2023, interviews for the mathematics teachers and a van Hiele test for geometric thinking were used to collect data, descriptive statistics and Mann-Whitney U test were used for the analysis, while the present study examined the effects of CAI on NCE II College of Education students' motivation and achievement in Geometry in Sokoto in 2024, used achievement test and motivation scale to collect data and used True-experimental design and descriptive statistics and t-test for data analysis. These variations formed the gaps that the present research intends to fill.

Isah and Hamza (2023) examined the influence of play way method of teaching among full time and part time NCE students' attitude in Mathematics in Shehu Shagari College of Education Sokoto State, Nigeria. It was recommended that play way method of teaching mathematics should be encouraged by stake holders in the education sectors. Because it improved student's motivation and achievement level.

METHODS AND PROCEDURES

The methodology encompasses the research design, population and sample, sampling technique, instruments for data collection, validity and reliability of instruments, procedure for data collection, and method of data analysis. The study adopts a true-experimental design, specifically a pretest-posttest experimental and control group design, involving the manipulation of variables with randomization to ensure equal selection chances. The population comprises all NCE II Mathematics students in Sokoto State, with Shehu Shagari College of Education identified as the sole institution offering the relevant courses summing to 1,469. From this population, 76 students will be sampled using systematic random sampling, divided equally into experimental and control groups. Purposive sampling will select Shehu Shagari College, and simple random sampling will assign students to groups. The instrument of data collection used was the Students' Geometry Motivation Scale (SGMS) with a reliability of 0.86 assessed through factor analysis and expert review for the SGMS. Data collection will follow permissions from relevant authorities, involving pretests, a treatment phase with CAI for the experimental group and traditional lectures for the control group, and posttests. Data analysis will utilize descriptive statistics for research questions.

RESULT AND DISCUSSION

Research Question One: What are the pre-test and post-test motivation mean scores of the NCE II students taught Geometry using CAI and those taught using the traditional lecture methods?

Table 1: Pre-test and Post-test motivation mean scores of the NCE II students taught Geometry using CAI and those taught using the traditional lecture methods

Group	Pre-motivation scores			Post-motivation scores			Mean gain diff.
	N	Mean	SD	Mean	SD	Mean gain	
Experimental	38	33.16	7.92	68	10.211	34.84	25.39
Control	38	34.5	10.991	43.95	10.722	9.45	

Table 1 shows the Pre-test and Post-test motivation mean scores of the students in Geometry when taught using CAI and those taught using the traditional lecture methods. From

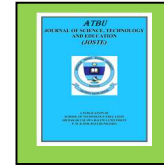
the result, the post-test motivation mean score (\bar{x} = 68.00, SD = 10.21) is higher than the pre-test motivation mean score (\bar{x} = 33.16, SD = 7.92) with a mean gain of 34.84, indicating that there was an

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increase in the motivation mean score of students after treatment. Also, for the control group the mean motivation score was 34.50 and a standard deviation of 10.99 for the pretest. The motivation mean score of students in the control group for the posttest increased to 43.95; with a standard deviation of 10.72. It further reveals that students in the experimental group had a higher motivation mean score after treatment using CAI than those in the control group who were not given treatment

with a mean difference of 25.39. This implies that students in the experimental group had higher motivation towards learning Geometry compared to the students in the control group.

Research Question Two: What is the pre-test and post-test motivation mean scores of NCE II male and female students taught Geometry using CAI?

Table 2: Pre-test and Post-test motivation mean scores of NCE II Male and Female Students in the experimental group

Gender	N	Pre-motivation scores		Post-motivation scores			
		Mean	SD	Mean	SD	mean gain	mean diff.
Male	27	32.88	7.84	65.69	10.17	32.81	6.44
Female	12	33.75	8.4	73	8.72	39.25	

Table 2 showed the Pre-test and Post-test motivation mean scores of male and female students taught mathematics using CAI. From the result, the post-test male students motivation mean score ($\bar{x} = 65.69$, $SD = 10.17$) is higher than the pre-test motivation mean score ($\bar{x} = 32.88$, $SD = 7.84$) with a mean gain of 32.81. For the female students the pre-test motivation mean score was 33.75 and a post-test mean score of 73.00 with a standard deviation of 8.72. Indicating that there was an increase in the motivation mean score of students after treatment with female students having a higher motivation. This implies that female students had a higher motivation towards Geometry when taught using CAI.

DISCUSSION

The finding of this study indicated significant differences in the motivation mean scores of NCE II Mathematics students taught Geometry using Computer-Assisted Instruction (CAI) compared to those taught using traditional lecture methods.

Research Question One revealed that the pre-test and post-test motivation mean scores of the students were analyzed. The experimental group, taught with CAI, showed a notable increase in motivation, with the mean score rising from

33.16 ($SD = 7.92$) to 68.00 ($SD = 10.21$), resulting in a mean gain of 34.84. In contrast, the control group, taught with traditional lecture methods, had a smaller increase in motivation, with the mean score increasing from 34.50 ($SD = 10.99$) to 43.95 ($SD = 10.72$), yielding a mean gain of 9.45. The mean difference of 25.39 between the experimental and control groups' post-test scores highlights the effectiveness of CAI in enhancing student motivation towards learning Geometry. This substantial difference suggests that CAI can significantly improve students' engagement and interest in Geometry compared to traditional teaching methods.

While on Research Question Two, it was discovered that there is a significant difference on the motivational level of male and female students in the experiment group. Even though, both male and female students in the experimental group showed an increase in motivation after the CAI treatment. Male students' mean scores rose from 32.88 ($SD = 7.84$) to 65.69 ($SD = 10.17$), with a mean gain of 32.81. Female students exhibited an even greater increase, with their scores improving from 33.75 ($SD = 8.40$) to 73.00 ($SD = 8.72$), resulting in a mean gain of 39.25. This indicates that while both genders benefited from CAI, female students experienced

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a higher boost in motivation compared to their male counterparts. This finding suggests that CAI may be particularly effective in engaging female students in Geometry, potentially reducing the gender gap in mathematics-related motivation and achievement.

The study demonstrates that CAI is a powerful tool in increasing student motivation in Geometry, with particularly strong effects observed among female students. These findings support the integration of CAI into the curriculum to foster better engagement and interest in mathematical subjects, ultimately enhancing educational outcomes.

RECOMMENDATION

Based on the findings that evolved of this study, the following recommendations were made: Educational institutions should prioritize the integration of Computer-Assisted Instruction (CAI) into Mathematics curricula, particularly for topics like Geometry. Furthermore, Teachers should receive comprehensive training as well as professional development in the use of CAI. This will ensure that educators are proficient in leveraging technology to maximize its benefits for student motivation and learning outcomes in Mathematics. In addition, Educators should develop and implement gender-sensitive teaching strategies. This could include tailoring CAI activities to appeal to diverse learning preferences and addressing any specific barriers that may hinder female students' engagement in mathematical subjects.

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