Computer- Aided Instruction Usage and Primary Schools Pupils' Attitude and Performance in Mathematics in Jos Metropolis Plateau State, Nigeria

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Dorcas Tabitha Wusa Ajayi (PhD) [1],Lucy Ucha Mbah[2] and Katkukah Danjuma Gokum (PhD)[3]
[1]Department of Science and Technology Education, Faculty of Education, University of Jos, Nigeria; [2]National Teachers' Institute, Plateau State Office, Jos, [3]Department of Curriculum Studies, Federal College of Education, Pankshin, Plateau State, Nigeria
wussyajayi@gmail.com[1], Chrisluc01@gmail.com[2],k-gokum@yahoo.com[3]

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Abstract - *The paper examined the effect of educational technology (computer-aided instruction CAI) in teaching on the attitude and performance of primary six pupils in mathematics in Jos metropolis. The aim was to examine how the use of computer-aided instruction in the teaching of mathematics will cause an improvement in the attitude and performance of pupils in mathematics. Four research questions were raised and two hypotheses was formulated to guide the study. The sample consisted of 151 pupils drawn from two public primary schools in Jos metropolis. The sample was divided into two groups called control and experimental groups. Pupils in the experimental group were taught mathematics using CAI while the central group was taught conventionally. Data for the study were elicited using a mathematics attitude scale (MAS) and a mathematics achievement test (MAT) designed by the researchers. The means score was used to answer all the research questions and t-test was used to test hypotheses. Results obtained showed that the attitude of pupils towards mathematics was negative before the treatment; also the pupils were below average in their performance in mathematics. After the treatment, pupils in the experimental group were found to have a more positive attitude and better performance than those in control group. It was recommended among other things that teachers of mathematics should endeavour to use CAI in their teaching of mathematics. The study concluded therefore that the use of educational technology (CAI) is effective in improving the attitude and performance of primary six pupils in mathematics.*

Keywords: *Attitude, Educational Technology, Computer-Aided Instruction(CAI), Performance and Teaching*

INTRODUCTION

Mathematics is the mother of all sciences. Majority of the giant strides in technological advancement are traceable to mathematics. Mathematics is useful in our everyday life. No aspect of human endeavour can survive without at least a little knowledge about mathematics. Beginning from Engineers to market women, down to the local cook, mathematics is needful and helpful [1].The indispensability of mathematics is typified in its being one of the compulsory subject to the point that a credit in mathematics is a prerequisite for admission into tertiary institution. As a result of the great importance of mathematics, the education sector is expected to provide sound training of students in mathematics to be able to produce competent and qualified graduates. In Nigeria, the education systemhas three levels namely; the primary, secondary and tertiary levels [3]. However, the primary level (which is the focus of the present research) is the basis or foundation of the other two levels. It is popularly referred to as the grassroot or basic education level. Primary education is the type of education given to children aged between 6 and 11 years[3]. The aim of primary education then is to lay a solid foundation for the other two levels. Again, mathematics is one of the core subjects recommended to be taught at all levels of education. The objectives of teaching mathematics

at the primary level include toachieve permanent numeracy and life-long skills [3] among others. If this objective must be achieved then the teaching and learning of mathematics must be made more effective.

At present, the performance and attitude of many pupils towards mathematics is poor and negative [4]. Results of students in mathematics at all levels of education have not been encouraging over the last decade [5]. Researchers have adduced several evidences that may have been the cause. Some of the factors according to [6] include poor teaching methods, poor use of learning aids, inadequate use of educational technology tools in teaching, incompetent mathematics teachers and others.

Furthermore, many young children fear to attend mathematics classes; they prefer other subjects take social studies, health education or civic education to mathematics. In essence, they tend to have negative attitude towards the learning of mathematics. Efforts directed at improving the attitude and performance of primary school pupils in mathematics include giving prizes for outstanding performance in mathematics, awarding of scholarship to pupils who excel in mathematics among others [7].

However, these efforts have not helped adequately enough because the performance and attitude of many young pupils towards mathematics are still on the negative side. This is the reason for a rethink about the tools to be used in the teaching of Mathematics. Educational technology is therefore defined as the process of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources[8]. This definition simply means that educational technology is a problem solving discipline in human learning. It has the potential of identifying and proffering solutions to problems in education (including poor performance and negative attitude) through its systematic approach to the development of instructional system and applying a complex-integrated approach to both human and non-human resources. In the same vein, educational technology is a problem solving approach that utilizes both process and product aspects in solving educational problems especially those that border on teaching and learning [9]. In essence, it tries to make use of all the tools(technological products and techniques system approach) that are quite necessary for the purpose of providing meaningful and interesting learning situations. It is possible that the problem may be due to the poor teaching tools Mathematics teachers use in teaching the subject. This also may be part of the reason why students develop negative attitude towards the study of Mathematics. Researchers like [4] noted that the mode of teaching of a subject has a way of influencing the attitude of students towards the subject as well as their performance. Continuing, [1] and [4] submitted that most students are bored with most traditional instructional strategies that do not have a multi- sensory effect; as such their attitude towards the subject may be negatively affected. There is need for an alternative approach to the teaching of Mathematics to be tried out; especially the teaching approach that can appeal to more than one sense organ at a time. The study is necessary because it will enlighten teachers especially those of Mathematics on the approach to adopt in teaching that has the propensity of arousing and retaining interest of students which will invariably influence their attitude. This is the reason why the researchers intend to examine how the use of educational technology tool in the form of computer-aided instruction (CAI) will be in remediating the problem of poor performances in and negative attitude of students towards Mathematics.

The study is significant for it will highlight the current state of mind of learners regarding mathematics which will serve as a guide for improvement. Stakeholders in education will be adequately informed about the indispensability of mathematics. Parents and guardians will be challenged to assist mathematics teachers (at home) to see that their wards develop positive attitude towards mathematics which will invariably influence their performance

Statement of the Problem

The problem of negative attitude and poor performances of students in Mathematics have caused great concern to all stakeholders in education. The situation causes so much worry when one considers the harm it is causing to the attainment of national objectives and goals of education. The great importance of Mathematics presupposes that all learners should have positive attitude towards it and also perform well. However, contrary to expectations, many school children fear mathematics and as such perform poorly in same. Results of students in mathematics at both internal and external examinations have consistently showed poor

performances orchestrated by negative attitude towards mathematic. Though researchers in time past have made several efforts to curb poor performance of students in mathematics, [10], yet these concerted efforts did not succinctly address the problem. The danger here is that if the current trend of negative attitude of pupils towards mathematics and the attendant poor performance continue unabated, the desire of achieving permanent numeracy among young learners may be on illusion and this will affect progression to higher levels of education.

Now the problem of this study is therefore to examine whether the use of computer-aided instruction in teaching will help improve students' performance and attitude towards mathematics.

Purpose of the Study

The general objective of the study is to examine how the use of CAI in teaching mathematics will help improve the attitude and academic performance of primary six pupils in Mathematics in Jos metropolis. The specific objectives of the study include to ascertain the level of performance of primary six pupils in mathematics before exposure to CAI, determine the nature of attitude of primary six pupils towards mathematics before exposure to CAI, ascertain the performance of primary six pupils in mathematics after exposure to CAI and to determine the direction of attitude of primary school pupils towards mathematics after exposure to CAI.

Research Questions

The following research questions were raised:

1. What is the attitude of primary six pupils towards mathematics before exposure to CAI in Jos metropolis?
2. What is the level of performance of primary six pupils in meathematics before exposure to CAI in Jos metropolis?
3. To what extent does exposure of primary six pupils to CAI impact on their attitude towards mathematics in Jos metropolis?
4. To what extent does the use of CAI in teaching influence the performance of primary six pupils in mathematics in Jos metropolis?

Hypotheses

The underlisted hypotheses were tested at 0.05 level of significance.

1. There is no significant difference between the mean score of primary six pupils exposed to CAI and those not exposed to in Jos metropolis.
2. The performance mean scores of primary six pupils in mathematics who were taught with CAI will not differ significantly from those taught without.

METHOD

The study adopted quasi-experimental design; with particular interest in pretest-posttest control group design. The population consisted of 4,102 primary six pupils in all the state and federal government-owned primary schools in Jos metropolis. The sample for the study consists of 151 pupils randomly selected from two primary schools within the study area. The 151 pupils were made up of 70 males and 81 females. The sample (151) is divided into two groups called experimental and control groups. There were 72 students and 79 students in experimental and control groups respectively. Data were obtained using an attitude scale and a mathematics achievement test designed by the researchers. The instruments were validated by three experts in Mathematics Department of the rank of professor from University of Jos, with reliability index of 0.73 and 0.81 respectively for the attitude scale and Mathematics achievement test respectively.

One of the researchers taught Mathematics to both groups. However, the pupils in the experimental group were taught with CAI, while the control group were taught conventionally (without CAI); after which the researchers administered the attitude scale and mathematics achievement test to obtain pupils' initial level of performances. At the completion of the treatment schedule, the researchers re-administered the attitude scale and the mathematics achievement test to the two groups to obtain the posttest scores. Both pretest and posttest scores of each of the groups were recorded separately. The statistical procedures mean score were used to answer the research questions, while t-test were used to test the hypotheses at 0.05 significance level.

RESULT

The table 1 shows that the attitude mean scores of control and experimental groups are 1.23 and 1.36 respectively; while the group mean difference is 0.07. This result means that both groups are low in attitude indicating a negative attitude towards mathematics.

Hence it could be deduce that primary six pupils have negative attitude towards mathematics before exposure to CAI.

Table 1. Attitude Mean Score of control and Experimental Groups Pupils Towards Mathematics in Jos Metropolis

Groups	N	Attitude Mean Scores	Group Mean Different
Control	72	1.23	0.07
Experimental	79	1.30	
Total	**151**		

Table 2: Mean Performance of Control and Experimental Group Pupils in Mathematics

Groups	N	Mean Scores	Group Mean Difference
Control	72	24.03	0.07
Experimental	79	22.90	
Total	**151**		

The table also indicates that the pretest mean performance in mathematics of primary six pupils in control and experimental groups are 24.03 and 22.90 respectively. The group mean difference is 1.13. This means that the two groups were very poor (below average) in performance in mathematics before exposure to CAI.

Table 3:Mean/Mean Gain in Attitude Scores of Control and Experimental Group Pupils

Groups	Type of Test	N	Mean	Mean Gain
Control	Pretest	72	1.23	0.36
	Posttest	72	1.59	
Experimental	Pretest	79	1.30	2.20
	Posttest	79	3.50	

The posttest attitude mean scores of control and experimental groups are 1.59 and 3.50 respectively as against their pretest mean scores in attitude of 1.23 and 1.30 respectively. The mean gain in attitude scores of control group is 0.36, while that of experimental group is 2.20 indicating that the experimental group had a better attitude (positive) than the control group. It can then be concluded that the exposure of pupils in experimental group improved their attitude towards mathematics positively.

Table 4: Mean/Mean Gain in Scores in Mathematics of Experimental and Control Groups

Groups	Type of Test	N	Mean	Mean Gain
Control	Pretest	72	24.03	
				12.55
	Posttest	72	36.58	
Experiment	Pretest	79	22.90	
				55.69
	Posttest	79	78.59	

Table 4 shows that the mean gain in scores of control group is 12.55 while that of experimental group is 55.69. This means that the mean gain of experimental group is much higher than that of control group. This result shows that pupils taught with CAI performed better in mathematics than those taught conventionally. By implication, it then means that the use of CAI in teaching mathematics improved the performance of pupils in mathematics.

Table 5: T-test Comparison of the Attitude Mean Scores of Pupils

Groups	Mean	S.D	DF	t-cal.	Remark
Control (N=72)	1.59	1.013			Reject
Experiment			149	2.323*	Ho_1
(=79)	3.50	2.115			

**S = Significant; critical tabular value: 1.960*

From Table 5, calculated t-value 2.323 is greater than critical t-value of (1.960) at degree of freedom of 149; hence the null hypothesis is rejected. The study concludes that there is positive significant difference between the attitude mean score of primary six pupils exposed to CAI and those not exposed to. The performance mean scores of primary six pupils in mathematics who were taught with CAI will not differ significantly from those taught without CAI.

Table 6. t-test Comparison Scores of Experimental and Control Groups When Exposed to CAI and when Not in Teaching Primary Six Mathematics

Groups	Mean	S.D	DF	t-cal.	Remark
Control	36.58	2.001			
Experimental	78.59	2.513	149	3.612	Rejected

S = Significant ; critical tabular value: 1.960

Table 6 shows that calculated t(3.612) is greater than table value (1.960), hence, there is significant difference between the performance of experimental and control groups' pupils in primary six mathematics; therefore, the null hypothesis is rejected. This leads to a conclusion that pupils exposed to CAI performed better in mathematics than those taught without.

DISCUSSION

The attitude of pupils towards mathematics was negative before the treatment. This may be due to the age long notion that Mathematics is hard. It is clear that students come from homes to school. The type of feeling they bring from home has a way of influencing their attitude towards school in general and the learning of Mathematics in particular. This corroborates [11]who noted that many students are skeptical about mathematics even before they come to school. This fear makes them develop negative attitude or ill feelings about mathematics. The mathematics teacher in such a class will face the challenge of first working on the mindset of students to help them disabuse their minds of the inherent ill-feelings about Mathematics before the students can understand the Mathematics lesson. Allport[12] noted that attitude affects behaviour and as such can determine outcomes whether favourable or otherwise.

The pretest performance of the pupils in mathematics was poor before the treatment in the two groups. This result is not surprising because the students used in study as at then were having negative attitude towards the study of mathematics. Also, the students have not been taught the topics covered in the Mathematics achievement test administered. The few students that passed may have passed due to the influence of their previous knowledge in Mathematics. This finding corroborates [13] who noted that mathematics topics are related; hence a knowledge in one aspect serves as a stepping stone to doing well in other related topic. However, the failure may be due to poor background knowledge in Mathematics or it could be linked to their inherent ill feeling about Mathematics which leads to negative attitude towards mathematics. Allport [12] defines attitude as one's feeling or disposition towards an attitude object. In this regard, it then follows that attitude determines one's interest or otherwise in a thing. With regards to the study of Mathematics it could be said that students' attitude determines their interest in Mathematics. When students have positive attitude towards the learning of Mathematics, (attitude object) their interest in Mathematics is bound to be high. The heighten interest will lead to better performance. But if however the attitude is negative, performance will dwindle. This may be the reason for the observed poor performance of pupils in Mathematics.

It was discovered that the attitude of students in the experimental group (those exposed to CAI) greatly improved more than the control group after the treatment. The reason may be due to the effect of the use of CAI which has the ability to appeal to many sense organs at a time and as such has the propensity to wade away boredom and weariness during lesson. It is imperative to point out that the researcher in the course of the study used computer- aided instruction powered by power point that shows pictures, voices as well as graphics. By this, the use of CAI in the teaching of mathematics to the experimental group was able to appeal to the sense organ of sight, hearing and perception at the same time. This multisensory approach to the teaching of mathematics may have helped students to clearly understand the concepts taught which invariably impacted on their attitude. This is in consonance with [14] and [15] who noted that the use of valid and interesting (multi-sensual learning aid) has the propensity to positively arouse interest of learners in a given subjects. It could be that the use of CAI which appealed to more than one sense organ at a time helped to arouse pupils' interest in mathematics by opening their natural gateways of learning. This is the only explanation for the observed improvement in the attitude of students in experimental group towards mathematics.

The performance of pupils in the experimental group in mathematics greatly improved after exposure to CAI. This is not surprising. It could be traced to the improvement in the attitude of the students. The use of CAI which appeals to many sense organs at a time created needed interest in students and equally sustained same. Many students get bored with the learning of Mathematics when the classroom environment is too traditional, lonely and uncaptivating. The use of monotone (traditional or conventional teaching approaches) in the teaching of mathematics contributed to boredom of students during mathematics lessons. Monotony they say kills interest and variety is the spice of life, hence students need something new (in the area of teaching method in mathematics) to spice up their zeal in the subject

which has been low over the years. No wonder why the students in the experimental group felt excited during the period of teaching mathematics. The excitement they had may be a major contributory factor to their improved attitude and performance in Mathematics. The use of traditional mode of teaching may be the main reason why a lot of students develop negative attitude towards Mathematics.[16] discovered that a high positive relationship exists between attitude and academic achievement. In essence, positive attitude leads to high scores or performance and vice-versa. It could be that the use of CAI .It may be that the development of interest in pupils via the use of CAI may have helped the students in experimental group to better adjust their mind to learn Mathematics than their counterparts who were not expose to CAI.

Similarly, the testing of hypothesis one which was on the comparison of the attitude mean scores of students exposed to CAI and those taught conventionally found out that students exposed to CAI had positive attitude (after the treatment) than those taught conventionally. This result could be traced to the multiple effect of the CAI as a means of teaching mathematics. The introduction of the CAI may have influenced students' attitude during lesson due to a change in the classroom environment via the use of CAI. [17]submitted that many factors influence attitude which the nature of one's environment is one of the factors. The change of the classroom environment from being boring via the introduction of CAI may have influenced the students in the experimental class positively which resulted in their change of attitude to positive.

In the same vein, it was discovered that students in the experimental group performed better in the post test than their counterpart in the control group. This improved performance in academic achievement may not be unconnected to improvement in the attitude of students towards mathematics which was orchestrated by the use of CAI in the teaching of Mathematics in the experimental group. This improvement in their attitude resulted to their corresponding improvement in academic performance. This finding is in agreement with[18] who observed that one of the factors that affect academic performance is attitude. Attitude says [19] determines altitude. This statement by [19] simply means that with regards to the learning of mathematics the level to which students have positive attitude towards the learning of Mathematics will determine how well they will pass it or score good grades. One would not be wrong by concluding that the observed improved performance in Mathematics by pupils in the experimental group(exposed to CAI) is as a result of their improved attitude and mindset towards mathematics. In the same way, the visual part of the CAI was helpful in recalling and remembering by students. This corroborate [20] who study showed that use of pictures is effective in improving achievement because the study will always form mental picture of what they have learnt in their brain and this mental picture will aid retention and retrieval of the learned facts thereafter. Furthermore, learning a task becomes easier when the parts of the body are actively involved because the human sense organs are the natural gateways to learn. Therefore, any teaching strategy that actively engages the natural gate ways during teaching will be potent and effective in leading to improved learning outcomes.

CONCLUSION AND RECOMMENDATION

The recurrent poor performance of pupils in mathematics and the age-long notion that mathematics is hard necessitated the study which aimed at examining how the use of CAI will help find solution to observed problems in the learning of mathematics in primary schools in the study area. It was discovered from the study that the students had negative attitude before the commencement of the experiment/ treatment. This was as a result of the already established ill feelings students have about mathematics even before they come to school. The use of CAI in teaching was meant to arouse interest of the learners and invariably influence their performance by the fact that the CAI appeals to more than one sense organ at a time. This multi-sensory effect of the CAI argued [15] is believed to be effective in opening students' natural gateways to learning.[21] equally noted that students do better when all or most parts of their bodies take active part in learning. This was made possible by the use of CAI in the teaching mathematics. This may be the reason why students in the experimental group perform better than their counterpart in the control group. From the findings, it was concluded that the use of CAI in teaching mathematics was effective in improving both attitude and performance of primary six pupils in mathematics in Jos Metropolis. In essence it has been proven empirically that the use of CAI in teaching is effective in improving students' attitude and academic

achievement in Mathematics. Consequently, teachers can trial test the method(the use of CAI) to ascertain its viability in their unique subjects and location.

It is recommended that teachers should always adopt the use of CAI in order to be effective in improving students' attitude and performance in mathematics, hence teachers of mathematics should incorporate CAI in their teaching of mathematics. The use of CAI helped to improve students' performance in Mathematics; it is recommended that teachers of mathematics go for computer training to be able to use CAI effectively. Government and PTA should help schools procure ICT laboratories and equipments to facilitate the teaching and learning of mathematics.

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