

# EFFECTIVENESS OF COMPUTER AIDED INSTRUCTION STRATEGY ON MIDDLE BASIC EDUCATION PUPILS' RETENTION IN QUANTITATIVE REASONING IN ENUGU STATE

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## **Abstract**

*The purpose of this study was to investigate the effectiveness of Computer Aided Instruction (CAI) strategy on middle basic education pupils' retention in quantitative reasoning. Two research questions and three hypotheses guided the study. Quasi experimental research design was adopted in the study. This study was conducted in Enugu Education Zone of Enugu State. The population for the study consisted of all middle basic two Pupils in the 98 public and private schools in Enugu Education Zone' numbering 8924 pupils in 2019/2020 academic session. The sample for the study consisted of 490 Middle Basic II (Primary Five) pupils. Stratified, purposive and simple random sampling techniques were adopted for the sampling. The instrument for data collection was Quantitative Reasoning Retention Test (QRRT). The instrument was constructed by the researcher and was validated by three research experts, two in mathematics education and one in measurement and evaluation. Kuder-Richardson 20 Formula was used to establish a reliability coefficient of .77 for QRRT. Data on retention was collected using QRRT. The treatment lasted for six weeks. Pretest score was collected before the treatment while posttest was administered after the treatment using QRRT. Research questions were answered using mean with standard deviations while the research hypotheses were tested using analysis of co-variance (ANCOVA). Mean and standard deviation were used to answer the research questions while test of hypotheses was done using Analysis of Covariance (ANCOVA) at 0.05 level of significance. Findings of the study showed among others that pupils taught quantitative reasoning with CAI retained more than their counterparts taught with expository method. School ownership did not significantly affect the retention of the students in quantitative reasoning. It was recommended among other things that use of CAI for*

*teaching quantitative reasoning in middle basic education should be adopted by all public and private schools in Enugu State.*

**Keywords: Computer Aided Instruction (CAI), Retention, Quantitative Reasoning.**

## **Introduction**

Good education is very important for everyone, regardless of gender or race, as it enables high quality learning throughout life for people of all ages, shapes, beliefs, religions and regions. The Federal Republic of Nigeria (FRN, 2013) states in its national education policy that modern education technologies are increasingly used at all levels of the education system and should also be improved in the teaching and learning process. More importantly, the policy continues to suggest that educational activities are learner-centered for maximum self-development and self-actualization. The policy emphasizes that mathematics should be visualized as the vehicle to train a child to think, reason, analyze and articulate logically, apart from being a specific subject it should be treated as concomitant to any subject involving analysis and reasoning such as quantitative reasoning. It is good to note here, that strong foundational learning gives root to later learning as basic concepts create connections necessary for inquiry and growth. When children are allowed the time and space to build strong foundations, the skills built later on come more easily and solidly. Lack of foundational skills weakens the learners as they move on to more and more challenging work. The philosophy and structure of the 9-Year and the Revised 9-Year Basic Education Curricula (BEC) in Nigeria are categorized into Lower Basic (Primaries 1-3), Middle Basic (Primaries 4-6) and Upper Basic (Junior Secondary 1-3). Thus the 9-Year BEC addressed among other things, the issue of value re-orientation, poverty eradication, critical thinking, entrepreneurship and life skills and also the laying of a sound basis for scientific and reflective thinking, Federal Ministry of Education (FME, 2012). Quantitative reasoning as a subject in the early stage of learning is incorporated in mathematics. Reasoning is defined as the ability of deliberately making sense of things, applying logic and adapting or justifying practices, institutions and beliefs based on new or existing information. Quantitative reasoning simply refers to the application of basic mathematical skills to the analysis and interpretation of real life quantitative information (Imuno, 2015). According to Nwibo and Ngene (2020), quantitative reasoning is a scientific activity that stimulates cognitive reasoning via creative and innovative application of the problem solving techniques. Quantitative reasoning is basically hinged on mathematical operations as basic arithmetic concepts are explained and simple instructions for the exercises are given. Hence, like mathematics, quantitative reasoning is designed to help the learners learn perfect mathematical operations and see relationships between or among different quantities (numbers), thus improving the pupils' logical manipulations with numbers. The aim of quantitative reasoning at this early stage of Basic Education is to sharpen the skills of pupils in dealing with figures mentally. This is very necessary for understanding

mathematics as a subject; therefore, the introduction of quantitative reasoning at these levels of education is no doubt, a step in the right direction. Hassan (2014) asserted that middle basic education plays the more important role of preparing the child for challenges by helping the child to engage his thinking faculty under any given circumstance. It also prepares the child to learn on reason before making a choice while also emphasizing how important it is to give attention to details.

Evidently, when pupils manipulate numbers logically, critical thinking, creative reasoning and innovative skills are gradually formed in them. Unfortunately, the academic performance of pupils in quantitative reasoning in basic education, tend to be on the decline as a result of the pupils' poor ability to retain what was taught. Retention is the act or process of holding what has been absorbed or assimilated. Oluremi (2018) defined retention as the act of "absorbing and holding" or to continue "having or holding". More worrisome, is the fact that research evidences such as Hassan (2014), Imuno (2015) and Julius (2015) have implicated teacher incompetency and use of unproductive teaching strategies as strong limiting factors to pupils' retention in quantitative reasoning. This calls for the need to promote activity-types and analytical kinds of teaching and learning such as Computer Aided Instruction (CAI) strategy. In order to overcome the difficulties faced by the students, teacher should adopt different methodology in teaching of mathematics like drill method, using different audio visual aids, computer aided instruction, mathematical club etc. CAI strategy refers to the use of computer to give course content instruction in the form of drill and practice, tutorials and simulations, (Sedega, Mishiwo, Fletcher, Kofi & Awudetsey, 2017). In the words of Suleman, Hussain, Din and Iqbal, (2017), CAI is an instructional strategy where a computer is used to communicate the instruction and also evaluate the learning outcomes. Gana (2013), noted that CAI refers to virtually any sort of computer application in instructional settings comprising of information instruction, drill and practice, simulations, instructional exercises, instructional management, database development, programming, composing using word processors, and other different applications.

The type of CAI used by the researcher in the course of this work is the information instruction. This type of CAI helps the learner get the desired information needed. Hence, the computer can serve the role of an enquiry officer, to respond to the students' enquiry with answers it had stored. The sole purpose of this type of CAI is to provide essential information for the acquirement of concepts and skill. Computer Aided Instruction strategy in this context, refers to the use of computer by the teacher during instruction to help students learn the desired course contents and be able to develop achievable goals in the future. The CAI is not expected to do the teaching; rather it serves as an instructional aid with which the teacher shall drive home the required points to the learners. As interesting as Computer-Aided Instruction may sound, some researchers such as Akpan (2014), Baraje (2015) and Buckie (2016) reported in their

separate studies that CAI inhibited pupils' learning. This, therefore, raises serious questions and worries, thus motivating a study of this nature aimed at investigating the effect of Computer Aided Instruction Strategy on Middle Basic Education pupils' retention in quantitative reasoning. Another variable of interest to the researcher in this study is influence of school ownership on middle basic education pupils' in quantitative reasoning when taught with Computer Aided Instruction. School ownership in this work is categorized into two viz; public and private schools. The public schools, also known as state/federal government schools refer to schools owned, funded and overseen by the state or federal government.

Nigerian public schools today are characterized by neglect and abandonment, dilapidated infrastructures, vandalization/looting of facilities and obsolete teaching aids. Teachers in public schools continue to allege ill-motivation, denial of incentives and poor condition of service. As the teachers resort to hassle for survival, absenteeism and truancy become the order of the day, (Agbo, 2014). The story seems not to be in any way better in the private schools. Private schools are schools owned by non-governmental organizations or individuals. Private schools are known for high cost, yet the proprietors seem to shy away from money demanding ventures such as employment of qualified teachers, provision of instructional materials and other infrastructures good for conducive teaching and learning. So many private schools allegedly use quacks to teach middle basic pupils (Nduka, 2011). This has created more and more unmanageable social problems that should worry well-meaning educators and researchers. Also expected to worry researchers are conflicting findings on influence of school ownership on basic education pupils' retention in quantitative reasoning. For instance, Imuno (2015), Buckie (2016) and Wale (2016) found in their separate studies that basic education pupils in public schools retained higher in quantitative reasoning when taught with Computer Aided Instruction. Contrarily, Hassan (2014), Derbuck (2014) and Nuhu (2015) reported in their separate studies that basic education pupils in private schools retained higher in quantitative reasoning when taught with Computer Aided Instruction. This study therefore sought to bridge this gap by investigating the effectiveness of Computer Aided Instruction on middle basic education pupils' retention in Quantitative Reasoning with regard to their school ownership.

### **Problem Justification**

Evidently, Computer Aided Instruction Strategy ranks very high among innovative teaching strategies that have received consistent and wide recommendations by modern educators. However, there are still conflicting reports on the effectiveness of Computer Aided Instruction on the entire teaching and learning process, especially, at the basic education levels. Since there is no definitive conclusion, there is need for more studies in this area. Furthermore, proliferation of private schools in Nigeria today has raised more questions than answers. Research evidences have no agreed stand regarding

influence of school type (public/private) on basic education pupils' retention in various subjects including quantitative reasoning. These inconsistencies inform the choice of this study. The problem of this study, put in question form is: How does Computer Aided Instruction Strategy affect Middle Basic Education pupils' retention in quantitative reasoning with particular reference to their school type (public/private)?

### **Objectives of the Study**

The purpose of this study was to determine the effectiveness of Computer Aided Instruction (CAI) on Middle Basic Education pupils' retention in quantitative reasoning. Specifically, the study sought to;

1. Determine pupils' retention in quantitative reasoning when taught with CAI strategy and expository method.
2. Find out the retention of public and private school pupils in quantitative reasoning when taught with CAI strategy and expository method.

### **Research Questions**

The following two research questions guided the study.

1. What are the mean retention scores of pupils taught Quantitative Reasoning with Computer Aided Instruction strategy (experimental group) and their counterparts taught the same topics with expository method (control group)?
2. What are the mean retention scores of public and private schools' pupils taught Quantitative Reasoning with Computer Aided Instruction strategy (experimental group) and their counterparts taught the same topics with expository method (control group)?

### **Hypotheses**

The following research hypotheses were tested at 0.05 level of significance.

1. There is no significant difference between the mean Quantitative Reasoning retention scores of pupils in the experimental and control groups.
2. There is no significant difference between the mean Quantitative Reasoning retention scores of public and private schools' pupils in the experimental and control groups.
3. There is no interaction effect of teaching methods and school type on Middle Basic Education pupils' retention in Quantitative Reasoning.

### **Research Methodology**

The research design adopted in the conduct of this investigation is quasi-experimental design where a pretest–posttest, non-equivalent groups were used. Intact classes were randomly assigned to experimental and control groups which was used in this study. Though the groups may not be equivalent, the researcher has the advantage of knowing the pretest scores. Changes in scores from pretest to posttest can be used to determine the effect of the independent variable. This study was conducted in Enugu

Education Zone in Enugu State. Stratified, Purposive and simple random sampling techniques were adopted for the sampling. The population for the study consisted of all Middle Basic Two Education Pupils in the 98 public and private (registered) schools in Enugu Education Zone of Enugu State, numbering 8924 pupils. The population comprises of 6763 pupils in public and 2161 pupils in private schools. A sample of 490 Middle Basic II (Primary Five) Education Pupils was used for the study. The sample consisted of 244 public schools' pupils and 246 private schools' pupils. Also the sample was made up of 255 pupils in experimental group and 235 pupils in the control group. The sample was drawn from 12 intact classes in three public and three private schools randomly drawn from the three Local Government Areas in Enugu Education Zone. The instrument used for data collection was Quantitative Reasoning Retention Test (QRRT). Quantitative Reasoning Retention Test (QRRT) constructed by the researcher, is made up of 40 multiple choice items (questions) drawn from quantitative reasoning content area that was covered in this study. Each question had four options (letters A to D). Three of the options were distractors and only one option was the correct answer. QRRT was subjected to both face and content validity. A reliability powerof of .77 using Kuder-Richardson 20 Formula method.

At the beginning of the experiment both groups were giving the pretest. After the administration of the pretest, the quantitative reasoning teachers in the sampled schools conducted the experiment. The experimental group was taught quantitative reasoning using CAI while the control was taught same topic using expository method. The experiment was conducted during the normal school hours using the school time table for classes. The experiment was done for two weeks. At the end of the experiment, the post test was administered to the two groups by the teachers. The data collected from the pretest and post test were all marked and recorded accordingly. Research questions were answered using mean and standard deviation while test of hypotheses were done with Analysis of Covariance (ANCOVA) at 0.05 level of significance.

## **Results**

### **Research Question 1**

What are the mean retention scores of pupils taught quantitative reasoning with Computer Aided Instruction strategy (experimental group) and their counterparts taught the same topics with expository method (control group)?

**Table 1: Mean Retention Scores and Standard Deviation of Treatment and Control Groups.**

Group	N	Mean	SD	Mean Difference
Experimental	255	67.71	0.14	28.2
Control	235	39.51	2.01	

From table 1, the mean retention score and standard deviation of the experimental group were 67.71 and 0.14. For the control group, the mean retention score and standard deviation were 39.51 and 2.01 respectively. The experimental group has more retention than their counterparts in the control group. The standard deviation value of the experimental group was less than that of the control group, indicating that the mean retention score for experimental group was more reliable. Also the mean difference in retention scores for the two groups was 28.2.

**Research Question 2**

What are the mean retention scores of public and private schools’ pupils taught Quantitative Reasoning with Computer Aided Instruction strategy (experimental group) and their counterparts taught the same topics with lecture method (control group)?

**Table 2: Mean Retention and Standard Deviation of Public and Private Schools’ Students**

Group	N	Mean	SD	Mean Difference
Public (Expt.)	130	58.04	0.21	9.91
Private (Expt.)	125	67.95	0.09	
Public (Control)	114	39.11	1.32	
Private (Control)	121	40.02	1.01	0.91

From table 2 above the mean retention score and standard deviation of the public (experimental) were 58.04 and 0.21 respectively while that of private (experimental) were 67.95 and 0.09 respectively. Similarly, public (control) were 39.11 and 1.32 while that of private (control) 40.02 and 1.01 respectively. These results indicate that both groups (experimental and control) improved in their retention in both public and private schools. Based on school ownership (public and private), it seems that the retention did not differ much. Rather, the experimental group in both public and private schools retained higher than their counterparts in the control group.

**Hypothesis 1**

There is no significant difference between the mean quantitative reasoning retention scores of pupils in the experimental and control groups.

**Hypothesis 2**

There is no significant difference between the mean quantitative reasoning retention scores of public and private schools' pupils in the experimental and control groups.

**Hypothesis 3**

There is no significant interaction between teaching method and school type on Middle Basic Education pupils' retention in quantitative reasoning.

**Table 3: ANCOVA analyses of the students' Retention scores**

Source	Type III sum of squares	DF	Mean Square	F	Sig.	Decision
Corrected Model	1309.220	3	436.41	3.512	.000	S
Intercept	102713.044	1	102713.044	826.68	.000	
Teaching Strategy	1129.005	1	1129.005	9.09	.000	S
School ownership	930.606	1	930.606	7.49	1.433	S
Strategy*School ownership	890.406	1	890.406	7.166	2.110	NS
Error	60011.699	483	124.248			NS
Total	166983.98	490				

Table 3 shows ANCOVA analyses of the students' retention scores. For teaching strategy, the f-calculated value of 9.09 is significant at .000 significant level which is less than 0.05 level set for this study. Thus, teaching strategy had significant effect on retention of the pupils in this study. Consequently, hypothesis 1 is rejected as stated because there was significant difference between the mean quantitative reasoning retention scores of pupils in the experimental and control groups. For School ownership (public/private), the f-calculated value of 7.49 is significant at 1.433 significant level which is higher than 0.05 level set for this study. Hence, school ownership had no significant effect on students' retention scores in this study. As a result of this, hypothesis 2 is not rejected as stated because there was no significant difference between the mean quantitative reasoning retention scores of public and private schools' pupils in the experimental and control groups. For interaction (Teaching Strategy\*School ownership), the f-calculated value of 7.166 is significant at 2.110 which is higher than



0.05 level of significance set for this research. Thus, interaction effect is not significant i.e. there was no interaction effect of teaching methods and school type on Middle Basic Education pupils' retention in quantitative reasoning. Hypothesis 3 is therefore not rejected as stated.

### **Major Findings**

From the results presented above, the findings of this study can be summarized as follows;

1. Middle Basic Education pupils taught quantitative reasoning with CAI (experimental group) retained more than their counterparts taught same topics with expository method (control group).
2. The mean quantitative reasoning retention scores of public and private Middle Basic Education school pupils taught with CAI (experimental group) and those taught same topics with expository method (control group) did not differ significantly in the study.
3. There was no interaction effect of teaching strategies and school ownership on pupils' mean quantitative reasoning retention scores of pupils.

### **Discussion of Findings**

Findings made in this study indicated that CAI promoted higher retention in quantitative reasoning than expository method. The standard deviation values further implied that experimental group had lower number of extreme scores than the control group. This finding agrees with those of Oluremi (2014), Julius (2015), Wale (2016) and Nwibo and Ngene (2020) who affirmed the efficacy of CAI in promoting more retention than expository method. Contrarily, Deburck (2014) and Buckie (2016) reported that CAI inhibited students' retention in the various branches of quantitative reasoning they studied. Obviously, people who retain poorly are usually judged as poor learners. Learning as defined by Julius (2015) is a relatively permanent change in potential behavior which is acquired through practice or experience. Julius argue that "relatively permanent" in the definition connotes something stored or locked up somewhere, in other words, something retained. Furthermore, "potential behavior" in the definition implies something for a later use and this is the retrieval of something retained.

It is therefore interesting to find in this study that CAI enhanced the retention of the pupils in quantitative reasoning.

### **Conclusion**

The study concluded that Computer Aided Instruction strategy was more effective than the expository method in teaching quantitative reasoning amongst middle basic education pupils based on method and school ownership.

## **Recommendations**

From the finding of this study, the following recommendations are made:

1. Use of CAI for teaching quantitative reasoning in middle basic education should be adopted by teachers in all the public and private schools in Enugu State.
2. Nigerian teacher education curriculum should emphasize use of CAI in microteaching and teaching practice exercises to avail pre-service teachers more practical knowledge during their training.
3. All public and private schools should either employ a computer programmer or sponsor their computer teachers on a mandatory computer programming course.

## **References**

- Agbo, E. A. (2014) *Educational Development in Enugu State*. Enugu: Fecund Printing Press.
- Akpan, J. (2014). Effect of Computer Aided Instruction on Pupils' Interest and achievement in Quantitative Reasoning in Uyo Metropolis, Akwa-Ibom State. *International Journal in Science and Technology* 2(1)38-90.
- Baraje, K. (2015). Effect of Computer Aided Instruction on Pupils' Achievement and Interest in Quantitative Reasoning in Cape Town. *Journal of Mathematical Sciences*. <http://www.mathsedu.org.com>.
- Buckie, O. (2016). Effect of Computer Aided Instruction on Students' Retention in Quantitative Reasoning in Michigan, USA.
- Derbuck, K. (2014). Effect of Computer Aided Instruction on Middle Basic Education Pupils' Achievement and Retention in Quantitative Reasoning in Southern Educational District of Singapore. *International Journal in Science and Technology* 3(2) 140-194.
- Federal Republic of Nigeria (2013). *National Policy on Education*. (3<sup>rd</sup> Edition), Abuja. NERDC
- FME (2012). *The Revised 9-Year Basic Education Curriculum: Basic Science and Technology*. Lagos: NERDC Press.
- Gana, C. S.(2013). Effects of Computer assisted instruction with Animation on Achievement and retention of students of colleges of Education in Quantum Physics. Unpublished PhD Thesis, Department of Science Education, University of Nigeria, Nsukka.

- Hassan, T. (2014). Effect of Computer Aided Instruction on Pupils' Interest in Quantitative Reasoning in Auchi, Edo state. *International Journal in Science and Technology* 4(1) 1-25.
- Imuno, G. (2015). Effect of Computer Aided Instruction on Pupil's Interest in Quantitative Reasoning in Accra, Ghana. *Journal of Mathematical Sciences*. <http://www.mathsedu.org.com>.
- Julius, Q. (2015). Effect of Computer Aided Instruction on Student's Retention in Quantitative Reasoning in Scotland. *Journal of Mathematical Sciences*. <http://www.mathsedu.org.com>.
- Nduka, O. (2011) A Case for Mathematics Laboratory Techniques. *Journal of Mathematical Sciences*. <http://www.mathsedu.org.com>.
- Nuhu, U. (2015). Effect of Computer Aided Instruction on Students' achievement in Quantitative Reasoning in Zaria, Kaduna state.
- Nwibo, J.U. & Ngene, O.C (2020). Effect of Computer Aided Instruction on Middle Basic Education Pupils' Achievement and Retention in Quantitative Reasoning in Ebonyi State. *Journal of issues on Mathematics*, 11 (1) 63-70.
- Oluremi, Y. (2014). Effect of Computer Aided Instruction on Middle Basic Pupil's Retention in Shagamu Ogun state. *International Journal in Science and Technology* 5(5) 300-330.
- Sedega, B. C., Mishiwo, M., Fletcher, J.A., Kofi, G.A., & Awudetsey, J. (2017). Effect of computer assisted instruction (CAI) on senior high school students' achievement at pie chart and histogram in core mathematics. *British Journal of Education*, 5(9), 45-68. <https://www.eajournals.org/wp-content/upload>. Retrieved on 08/08/20.
- Suleman, Q., Hussain, I., Din, N.U. & Iqbal, K. (2017). Effects of computer assisted Instruction (CAI) on Students' Academic Achievement in Physics at Secondary Level. *Computer Engineering and Intelligent Systems*, 8(7), 9-17. <http://kubanni.abu.edu.ng/ispui/bitstream/123456789> on 08/08/20.
- Wale, P. (2014). Effect of Computer Aided Instruction on Pupils' Achievement and Retention in Quantitative Reasoning in Shagamu, Ogun State. *Journal of Mathematical Association of Nigeria (ABACUS)*, 25(1), pg. 82- 89.