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EFFECT OF COMPUTER AIDED INSTRUCTION ON MIDDLE BASIC EDUCATION PUPILS' ACHIEVEMENT AND RETENTION IN QUANTITATIVE REASONING IN ENUGU STATE.

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Abstract

The purpose of this study was to determine the effect of Computer aided instruction on Middle Basic Education Pupils' achievement and retention in quantitative reasoning. Four research questions and six hypotheses guided the study. Pretest-posttest non randomized control group design was adopted for the study. The study was conducted in all the six education zones in Enugu State, where a sample of 470 middle basic education pupils was drawn from 12 intact classes in 6 basic education schools (one from each of the six education zones in Enugu state). Techniques adopted for sampling was purposive and stratified random sampling. Instrument used for data collection was Quantitative Reasoning Achievement Test (QURAT). The instrument was constructed by the researchers and validated by three research experts. QURAT had 35 multiple choice items each with 4 options. It yielded a stability coefficient of .71 obtained through test –retest approach. QURAT also yielded a reliability coefficient of .68 obtained by Kudar-Richardson 20 formula. Research questions were answered using mean and standard deviation. Hypotheses were tested using Analysis of Covariance (ANCOVA). Major findings of the study showed that middle basic education pupil taught quantitative reasoning with computer aided instruction achieved higher and retained more quantitative reasoning than their counterparts taught same topics with expository method. Also, male and female middle basic education pupil did not differ significantly in their achievement and retention in quantitative reasoning when taught with computer aided instruction. It was recommended that computer aided instruction be used in teaching basic education schools quantitative reasoning.

Keywords: Effect, Computer Education, Middle Basic Pupils, Quantitative Reasoning, Enugu State.

Introduction

Reason is closely associated with such characteristically human activities as philosophy, science, language, quantitative reasoning and art is normally considered to be a distinguishing ability possessed by humans. George (2016) defined reason as the ability of deliberately making sense of things, applying logic and adapting or justifying practices, institutions and beliefs based on new or existing sin formation. Reason or an aspect of it is sometimes referred to as rationality. Georgy associated reasoning with thinking, cognition and intellect. The field of logic studies ways in which humans reason formally through argument. Reasoning may be subdivided into forms of logical reasoning (forms associated with the strict sense): deductive reasoning, inductive reasoning, abductive reasoning, quantitative reasoning and other modes of reasoning considered more informal, such as intuitive reasoning and verbal reasoning. Along these lines, a distinction is often drawn between logical, discursive reasoning (reason proper), and intuitive reasoning in which the reasoning process through intuition-however valid, may tend toward the personal and the subjectively opaque.

Dave (2015) averred that in some social and political settings, logical and intuitive modes of reasoning may clash, while in other contexts, intuition and formal reason are seen as complementary rather than adversarial. For example, in quantitative reasoning, intuition is often necessary for the creative processes involved with arriving at a formal proof, arguably the most difficult of formal reasoning tasks. Nuhu (2015) held that reasoning like habit or intuition, is one of the ways by which thinking moves from one idea to a related idea. For example, reasoning is the means by which rational individuals understand sensory information from their environments or conceptualize abstract dichotomies such as cause and effect, truth and falsehood or ideas regarding notions of good and evil. Reasoning as a part of executive decision making is also closely identified with the ability to self-consciously change in terms of goals, beliefs, attitudes, traditions and institutions and therefore with the capacity for freedom and self-determination, (Nuhu, 2015).

In contrast to the use of reason as an abstract noun, Natshi (2016) explained that a reason is a consideration given which either explains or justifies events, phenomena or behavior. Reasons justify decisions, reasons support explanations of natural phenomena, reasons can be given to explain the actions (conduct) of individuals. Using reason, or reasoning can also be described more plainly as providing good or the best, reasons. For example, when evaluating a moral decision, morality is, at the very least, the effort to guide one's conduct by reason, that is, doing what there are the best reasons for doing while giving equal (and impartial) weight to the interests of all those affected by what one does. Psychologists and cognitive scientists have attempted to study and explain how people reason. The field of automated reasoning studies how reasoning may or may not be modeled computationally.

Derbuck (2014) narrated that for many classical philosophers, nature was understood telelogically, meaning that every type of thing had a definitive purpose which fit within a natural order that was itself understood to have aims. Perhaps starting with great mathematical philosophers such as Pythagoras or Heraclitus, the cosmos is even said to have reason. Reason by this account, is not just one characteristic that humans happen to have and that influences happiness amongst other characteristics. Reason was considered of higher stature than other characteristics of human nature, such as sociability, because it is something humans share with nature itself, linking an apparently immortal part of the human mind with the divine order of the cosmos itself. Derbuck further narrated that within the human mind or soul, reason was described by Plato as being the natural monarch which should rule over the other parts, such as spiritedness and the passions. Aristotle, Plato's student defined human beings as rational animals, emphasizing reason as a characteristic of human nature. He defined the highest human happiness or well as a life which is lived consistently, excellently and completely in accordance with reason.

The conclusions to be drawn from the discussions of Aristotle and Plato on this matter, according to Derbuck are amongst the most debated in the history of philosophy. But teleological accounts such as Aristotle's were highly influential for those who attempt to explain reason in a way which is consistent with monotheism and the immorality and divinity of the human soul. For example, in the Neo-Platonist account of Plotinus, the cosmos has one soul, which is the seat of all reason and the souls of all individual humans are part of this soul. Reason is for Plotinus both the provider of form to material things and the light which brings individuals soul back into line with their source. Such Neo-Platonist accounts of the rational part of the human soul were standard amongst medieval Islamic philosophers and under this influence, mainly via Averroes, came to be debated seriously in Europe until well into the renaissance and they remain important in Iranian philosophy, (Imuno, 2015).

According to Imuno in the formulation of another mathematician Immanuel Kant who wrote some of the most influential modern treaties on the subject, the great achievement of reason is that it is able to exercise a kind of universal law-making. Kant was able therefore to reformulate the basis of moral-practical, theoretical and aesthetic reasoning, on universal laws. Here practical reasoning is the self-legislating or self-governing formulation of universal norms and theoretical reasoning is the way humans posit universal law of nature. Under practical reason, the moral autonomy or freedom of human beings depends on their ability to behave according to laws that are given to them by the proper exercise of that reason. This contrasted with earlier forms of morality, which depended on religious understanding and interpretation or nature for their substance. Kant posited that in a free society, each individual must be able to purse their goals however they see fit, so long as their actions conform to principles given by reason. He formulated such a principle, called the categorical imperative which would justify an action only if it could be universalized:

> Act only according to that maxim whereby you can at the same time will that it should become a universal law

In contrast to Hume, Kant insists that reason itself has natural ends itself, the solution to the metaphysical problems, especially the discovery of the foundations of morality. Kant claimed that this problem could be solved with his transcendental logic while unlike normal logic is not just an instrument which can be used indifferently as it was for Aristotle, but a theoretical science in its own right and the basis of all the others. Habermas in Buckie (2016) submitted that the substantive unity of reason has dissolved in modern times such that it can no longer answer the question "How should I live?" Instead, the unity of reason has to be strictly formal or "procedural". He thus described reason as a group of three autonomous spheres (on the model of Kant's three critiques);

i. **Cognitive-instrumental reason** is the kind of reason employed by the sciences. It is used to observe event, to predict and control outcomes and to intervene in the world on the basis of its hypotheses.
ii. **Moral-practical reason** is what we use to deliberate and discuss issues in the moral and political realm, according to universalizable procedures (similar to Kant's categorical imperative) and

iii. **Aesthetic reason** is typically found in works of art and literature and encompasses the novel ways of seeing the world and interpreting things that those practices embody.

For Habermas, these three spheres are the domain of experts and therefore need to be mediated with the "lifeworld" by philosophers. In drawing such a picture of reason, Habermas hoped to demonstrate that the substantive unity of reason, which in pre-modern societies has been able to answer questions about the good life, could be made up for by the unity of reason's formalizable procedures. This study is based on the first sphere described by Habermas, that is cognitive-instrumental reasoning. Hence, quantitative reasoning is a scientific activity that stimulates cognitive reasoning via creative and innovative application of the problem solving techniques, (Nneji and Udabah, 2020).

Quantitative reasoning (QR) simply refers to the application of basic mathematical skills to the analysis and interpretation of real life quantitative information. This can be made in the context of a discipline or an interdisciplinary problem to draw conclusions that are relevant to learners in their daily lives, (Dave, 2015). Dave further hinted that quantitative reasoning (QR) is synonymous with mathematics, and, indeed, the two are inextricably linked. QR as a mathematical skill is inclusive and its language plain and useful in everyday life activities.

The quantitative reasoning domain tests the learners' ability to use numbers and mathematical concepts to solve mathematical problems, as well as the learners' ability to analyze data presented in a variety of ways, such as in table or graph form. Only a basic knowledge of mathematics is required. All of the quantitative reasoning problems take the form of multiple-choice questions, that is, a question followed by four possible responses, only one of which is the correct answer. The quantitative reasoning sections consist of two categories of questions; questions and problems and graph or table comprehension. Questions and problems cover a variety of subjects taken from algebra and geometry. Some of the questions are presented in mathematical terms, others are word problems which you must translate to mathematical terms before solving.

Graph or table comprehension questions relate to information appearing in a graph or a table. A graph presents data in graphic form, such as a bar chart, line graph or scatter plot. A table represents data arranged in columns and rows. In general, all questions of a given type are arranged in ascending order of difficulty. The easier questions, requiring relatively less time to solve, appear first, with the questions becoming progressively more difficult and requiring more time to solve. The figures accompanying some of the questions are not necessarily drawn to scale. Do not rely solely on the figure's appearance to deduce line length, angle size and so forth.

However, if a line in a figure appears to be straight, the learner may assume that it is, infact, a straight line. A formular page appears at the beginning of each quantitative reasoning section. This page contains instructions, general comments and mathematical formulas, which the learner may refer to during the test. The formular page also appears in the guide and in the quantitative reasoning sections of the practice test. The learners should familiarize themselves with its contents prior to taking the test. Tackling quantitative reasoning problems can be done using a number of strategies. Natshi (2016) advised that when dealing with any type of quantitative reasoning problem, it's a good idea to have a plan. According to Natshi, there's a nice four-step process that George Polya, a Hungarian mathematician, developed to solve problems in general, and it can often be used to organize your thoughts and develop a plan to solve a given problem; understand the problem, devise a plan, carry out the plan and look back.

- Understand the problem: Reword it in your own words and read it as many times as necessary to understand it.
- Devise a plan: Come up with a way to solve the problem based on the information given, such as drawing a picture or diagram, translating the problem into numerical expressions, or working backwards, to name a few.
- Carry out the plan: Carry out the plan that you devised.
- Look back: Check your answer with the original problem. Make sure that it makes sense with the problem and that you carried out your plan correctly. If it checks out, great! If not, start over.

This process can aid in quantitative reasoning in that it gives a nice strategy on ways to think about the problem in an organized manner. This process can be used for any type of problem, but the quantitative reasoning comes in at steps two and three when we devise a plan and carry it out. Knowing how to identify the relationships among the quantities in the problem and connect those relationships to appropriate operations is quantitative reasoning at its finest, (Natshi, 2016).

The most important reason for inclusion of QR in the basic education curriculum, perhaps, is that in order to become educated person, learners should graduate from basic education schools with some level of competence in quantitative reasoning. For students in non-quantitative majors, the appropriate demand is that QR instruction act as a basic element of the 'liberal arts' curriculum; that it prepares learners to function well as citizens in modern society. Many learners do not learn sophisticated mathematics skills, but all should be able to use simple mathematical tools to reason, to understand, interpret, critique, debunk, challenge, explicate, and draw rational conclusions. In short, basic school graduates should be able to evaluate the crush of quantitative data which modern life throws at all literate persons.

Derbuck (2014) posited that QR appears to be much more than a general education learning outcome, it must be accomplished within the major, but also beyond it. QR is located at the intersection of critical thinking, basic mathematics skills, and the disciplines or real-world contexts for learning. QR must be taught in the context of the disciplines because a critical component of the outcome is the ability to identify quantitative relationships in a range of contexts. This is because the very nature of QR is interdisciplinary it involves contextual problem solving in real world situations. Yet, general education is where the various levels locate the teaching, learning, and assessment of core competencies like QR. One of the first decisions education planners must make when approaching QR learning is where in the curriculum learners will be expected to gain these skills, and thus, where the educators will both teach and measure it.

Examples of QR in everyday life abound and can be drawn upon to teach QR in the context of virtually any discipline. They can be found in areas such as health, economics, politics, science, engineering, social science, and even the arts. For example, virtually all parents face the vaccination question early in the life of their children. Parents might ask questions like, "What are the risks associated with vaccinating my child? What are the benefits?" In order to answer these questions, they must take into account quantitative information, such as disease occurrence rates in populations over time, or numbers of cases of complications with certain vaccine preparations. No doubt, one of the ways of promoting functional education in a third world country such as Nigeria is making mathematics and science more accessible and responsive to the needs of all citizens. One way to achieve this literacy may be through a more intensive focus on quantitative reasoning at basic education level.

Imuno (2015) averred that QR utilizes basic mathematics skills in the service of carrying out complex reasoning and decision-making processes. It is less about the how to perform the calculation and more about the meaning of the calculation results. Quantitative reasoning involves; abstract and deductive reasoning. It facilitates practical skills, robust habit of brainstorming and logical assessment. These skills can be employed in professions such as sciences, technology, and engineering as well as arts and humanities. Little wonder why United States of America extends quantitative reasoning to her tertiary education levels. According to the Mathematical Association of America (MAA) (2019), the following quantitative literacy (or QR) requirements should be established for all students who receive a bachelor's degree:

- Interpret mathematical models such as formulas, graphs, table, and schematics, and draw inferences from them.
- Represent mathematical information symbolically, visually, numerically, and verbally. Use arithmetical, algebraic, geometric, and statistical methods to solve problems.
- Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives, and select optimal results.
- Recognize that mathematical and statistical methods have limits.

Moreso, Julius (2015) reported that most high schools in developed nations of the world emphasize much on quantitative reasoning competency. In such high school, Quantitative Reasoning Requirement involves subjecting all freshmen to take a QR placement test. If they don't meet minimum standards, they must enroll in QR 140, a course that brings them up to competency. Once they have completed QR 140 (or if they have already passed the QR placement test) students must, at some point in their academic career, take a QR overlay course designed to engage students in the analysis and interpretation of data in a scientific or social context. The overlay course is intended to provide students with a basic understanding of important ways that numerical data are used in problem solving. Overlay courses are offered in the humanities, sciences, and social sciences. They have five basic goals (which echo the Quantitative Literacy requirements established by the Mathematical Association of America (MAA)).

Literacy: Topics and depth of coverage enough so that students have the knowledge they need to function in real-life situations involving quantitative data.

Authenticity: Students use authentic numerical data whenever possible. The experience should arise naturally from the context of the course.

Applicability: Examples should be adequate to convince students that the methods of analysis they learn are of general applicability and usefulness.

Understanding: It is important that student learning go beyond rote application. They should be able to recognize when they can apply what they have learned in the future.

Practicality: Breadth and depth of topics should be consistent with reasonable expectations of students when data analysis is only part of a course requirement.

Form the foregoing, the importance of QR cannot be overemphasized. Since developed Nations of the world teach QR at all levels of their educational system, (form basic to tertiary), it is high time Nigeria thinks in the same pattern. This fact justifies the need for a study of this nature which is aimed at improving the teaching and learning of QR in Nigeria basic schools. QR as shown above will develop its learners the skill of critical, logical and rational thinking.

This will not only aid the learners' understanding of mathematical concepts but also facilitate their learning and understanding of all other subjects. QR will also enable the learners make mature and reasonable judgments in their daily life activities. This study therefore aimed at finding out ways to help students achieve more in this vital subject.

Purpose of the Study

The purpose of this study was to investigate the effects of computer aided instruction on basic education schools' achievement and retention in quantitative reasoning. Specifically, the study aimed at investigating the effects of computer aided instruction on basic education school pupils';

i. achievement in quantitative reasoning
ii. retention in quantitative reasoning
iii. influence of gender in middle basic education pupils' achievement in quantitative reasoning
iv. influence of gender in middle basic education pupils' retention in quantitative reasoning
v. interaction between teaching method and middle basic education pupils gender on pupils' mean achievement scores in quantitative reasoning
vi. interaction between teaching method and middle basic education pupils gender on pupils' mean retention scores in quantitative reasoning

Research Questions

The following research questions guided the study

1. What are the mean quantitative reasoning achievement scores of middle basic education pupils in the experimental and control groups in both pretest and posttest?
2. What are the mean quantitative reasoning retention scores of middle basic education pupils in the experimental and control groups?
3. What is the influence of gender on middle basic education pupils' achievement in quantitative reasoning?
4. What is the influence of gender on middle basic education pupils' retention in quantitative reasoning?

Hypotheses

The following hypotheses were formulated and tested at .05 level of significance

1. There is no significant difference between the mean quantitative reasoning achievement scores of the middle basic education pupils' in experimental and control groups.
2. There is no significant difference between the mean quantitative reasoning retention scores of the middle basic education pupils' in experimental and control groups.
3. There is no significant difference between the mean quantitative reasoning achievement scores of male and female middle basic education pupils' in the experimental group.
4. There is no significant difference between the mean quantitative reasoning retention scores of male and female middle basic education pupils' in the experimental group.

5. There is no significant interaction between teaching method and gender on middle basic education pupils’ mean achievement scores in quantitative reasoning.
6. There is no significant interaction between teaching method and gender on middle basic education pupils’ mean retention scores in quantitative reasoning.

Methodology

The research design adopted in the conduct of this investigation was quasi-experimental design. Specifically, the design was a pretest –posttest, non equivalent control group design. The area covered in this study was Enugu state of Nigeria from where one (1) basic education school was randomly drawn from each of the six education zones. This gave a total, of six (6) basic education schools. Two intact classes were also randomly drawn from each of the (6) basic education schools, hence, a total of (12) intact classes were used for the study. All the middle basic education pupils’ in the (12) intact classes, numbering (470) served as sample for the study. The sample was made up of (230) middle basic education pupils’ in the experimental group and (240) middle basic education pupils’ in the control Group. The sample also composed of 245 female middle basic education pupils’ and 225 male middle basic education pupils’.

Quantitative reasoning Achievement Test (QURAT) was used to collect achievement (pretest and posttest) scores. A re-arranged version of QURAT was also used to collect retention scores two weeks after the posttest. QURAT was developed by the researchers. It was made up of (35) multiple choice questions. Each of the questions had four options from which the testee is expected to choose the right answer. The items were drawn using a table of specification to ensure adequate coverage of the content area covered in the study as well as maintain even spread across the different levels of the cognitive domain tested. QURAT was validated by three research experts. After necessary corrections as directed by the experts, QURAT was confirmed to have face and content validity. QURAT yielded a stability coefficient of .71 obtained through test –retest approach. QURAT also yielded a reliability coefficient of .68 obtained by Kudar-Richardson 20 (KR-20) formula.

Experimental Procedures

The researchers trained the (6) regular quantitative reasoning teachers in the (6) basic education schools used for the study for a period of two weeks on the use of computer aided instruction. This number of research assistants (6) was necessary because the study covered the entire six education zones in Enugu state. These necessitated conducting the experiment in (6) basic education schools. Fore-most, the QURAT was administered to all the subjects of the study as pretest. Thereafter, the treatment was administered for a period of six weeks. The experimental group in each school was taught the selected quantitative reasoning topics using computer aided instruction while the control group in each school was taught the same topics using expository method. All topics were drawn from primary school scheme of work. At the expiration of the treatment period, the QURAT was re-arranged and administered to all the participants as posttest. After two weeks of posttest, QURAT was further re-arranged and administered to all the participants as retention test. Research Questions were answered using mean and standard deviation. Test of hypotheses were done with Analysis of Covariance (ANCOVA) at .05 level of significance.

Results

Research Question 1: What are the mean quantitative reasoning achievement scores of middle basic education pupils in the experimental and control groups in both pretest and posttest?

Table 1: Mean Achievement scores of experimental and control groups in pretest and posttest.

Group	n	Pretest		Posttest	
		Mean	SD	Mean	SD
Experimental	230	39.80	0.23	85.44	0.26
Control	240	40.00	0.21	50.00	0.10

In table 1, the pretests mean achievement score and standard deviation of the experimental group were 39.80 and 0.23 respectively and the posttests were 85.44 and 0.26 respectively. For the control group, the pretest mean achievement score and standard deviation were 40.00 and 0.21 respectively while the posttest mean achievement scores and standard deviation were 50.00 and 0.10 for respectively. There was not much difference between the two groups in the pretest but there was an appreciable difference in the posttest. The experimental group scored much higher with a lower standard deviation than the control group.

Research Question 2: What are the mean quantitative reasoning retention scores of middle basic education pupils in the experimental and control groups?

Table 2: Mean Retention scores of Experimental and control groups

Group	n	Mean	SD
Experimental	230	77.10	0.11
Control	240	38.21	0.05

From table 2, the mean retention score and standard deviation of the experimental group were 77.10 and 0.11 respectively. While those of the control group were 38.21 and 0.05 for mean and standard deviation respectively. This result indicates that the experimental group retained more than the control group.

Research Question 3: What is the influence of gender on middle basic education pupils' achievement in quantitative reasoning?

Table 3: Mean Achievement scores of Male and Female students in pretest and posttest.

Group	n	Pretest		Posttest	
		Mean	SD	Mean	SD
Male	225	38.00	0.72	84.50	0.43
Female	245	40.11	0.95	85.00	0.21

Table 3 above in the pretest, male middle basic education pupils had 38.00 and 0.72 for mean and standard deviation respectively while the female had 40.00 and 0.95 for mean and standard deviation also. Similarly, in the posttest, male middle basic education pupils had 84.50 and 0.43 for mean and standard deviation respectively while the female had 85.00 and

0.21 for mean and standard deviation also. Evidently, there was no much difference in the achievement of the middle basic education pupils from different genders.

Research Question 4: What is the influence of gender on middle basic education pupils' retention in quantitative reasoning?

Table 4: Mean Retention scores of Male and Female middle basic education pupils in the experimental and control groups.

Group	n	Mean	SD
Male	225	76.81	0.20
Female	245	76.99	0.25

From table 4, the mean retention score for male middle basic education pupils was 76.81 with a standard deviation of 0.20 while it was 76.99 and 0.25 for female middle basic education pupils mean and standard deviation respectively. Just as in the achievement scores, there seems not to be much difference between the retention of the middle basic education pupils of different gender.

Hypothesis 1: There is no significant difference between the mean quantitative reasoning achievement scores of the middle basic education pupils in experimental and control groups.

Hypothesis 3: There is no significant difference between the mean quantitative reasoning achievement scores of male and female middle basic education pupils in the experimental group.

Hypothesis 5: There is no significant interaction between teaching method and gender on middle basic education pupils' mean achievement scores in quantitative reasoning.

Table 5: ANCOVA Analyses of the middle basic education pupils' Achievement Scores

Source of Variance	**Sum of squares**	**DF**	**Mean squares**	**F-calc.**	**Sig**	**Remark**
Gender	113.21	1	113.21	1.391	3.21	Not Significant
Method	309.01	1	309.01	3.797	0.001	Significant
Gender*Method	181.00	1	181.00	2.224	4.00	Not Significant
Error	38005.12	467	81.381			
Total	**38608.34**	**470**				

From Table 5, gender as main effect gave an f value of 1.379 which is less than the critical value (3.21). Hence gender had no significant effect. Therefore, hypothesis three is not rejected as stated. Teaching method, (Experimental and control) as main effect gave an f value of 3.797 and this is greater than the critical value of 0.001. Hence teaching method affected the middle basic education pupils' achievement significantly and so hypothesis one is rejected as stated. The interaction effect (Gender*Method) gave an f value of 2.224 which is less than the critical value (4.00). This indicates no significant interaction. Thus, hypothesis five is not rejected as stated.

Hypothesis 2: There is no significant difference between the mean quantitative reasoning retention scores of the middle basic education pupils' in experimental and control groups.

Hypothesis 4: There is no significant difference between the mean quantitative reasoning retention scores of male and female middle basic education pupils' in the experimental group.

Hypothesis 6: There is no significant interaction between teaching method and gender on middle basic education pupils' mean retention scores in quantitative reasoning.

Table 6: ANCOVA analyses of the middle basic education pupils' retention scores

Source of Variance	**Sum of squares**	**Df**	**Mean squares**	**F-calc.**	**Sig**	**Remark**
Gender	90.00	1	90.00	1.519	2.004	Not Significant
Method	216.15	1	216.15	3.648	0.101	Significant
Gender*Method	88.21	1	88.21	1.489	2.221	Not Significant
Error	27666.00	467	59.241			
Total	**28060.36**	**470**				

From Table 6, gender as main effect gave an f value of 1.519 which is less than the critical value (2.004). Thus, gender had no significant effect on the middle basic education pupils' retention. Therefore, hypothesis four is not rejected as stated. Teaching method, (Experimental and control) as main effect gave an f value of 3.648 and this is greater than the critical value of (0.101). Hence teaching method affected the middle basic education pupils' retention significantly and so hypothesis two is rejected as stated. The interaction effect (Gender*Method) gave an f value of 1.489 which is less than the critical value (2.212). This indicates no significant interaction. Therefore, hypothesis six is not rejected as stated.

Discussion of Findings

Findings of this study suggest that both groups had similar entry behavior and achievement ability. Also, the wide gap between the mean pretest scores and the mean posttest scores showed that learning took place in both groups. However, the result indicates that there was significant difference between the achievements of the groups. Hence, the experimental group achieved higher than the control group. Also male and female middle basic education pupils' achieved equally. This shows that computer aided instruction is gender friendly. Going by this record, we can say, with certainty, that the achievement of the middle basic education pupils was as a result of the treatment administered to them. More so, extraneous variables were properly controlled. This implies therefore, that computer aided instruction promoted higher achievement in quantitative reasoning than expository method. Also computer aided instruction is not gender bias. The findings of this study support those of Imuno (2015) and Nuhu (2015). But the findings disagree with those of Derbuck (2014) and George (2016) who in their separated studies, reported that computer aided instruction inhibited middle basic education pupils' achievement in quantitative reasoning. The disagreement in the findings of these two sets of studies may likely be traced to experimenter's ability in controlling extraneous variables.

The findings of this study have supported the assertion of Buckie (2016) who posited that computer aided instruction are strategies that empower the learners to take charge of his/her own learning in a highly meaningfully fashion. Computer aided instruction promotes skills that the teacher and the learner use to achieve desired goal. It is therefore necessary that middle basic education teachers (especially quantitative reasoning teachers get acquainted with the use of computer aided instruction in teaching and learning).

Conclusion

Based on the findings of this study, the following conclusions were made: computer aided instruction elicited higher achievement in quantitative reasoning than the expository method. It elicited higher retention in quantitative reasoning than the expository method. Middle basic education pupils' gender did not significantly affect their achievement and retention in quantitative reasoning especially when taught with computer aided instruction. Hence, computer aided instruction is gender friendly.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Use of computer aided instruction for teaching middle basic education school quantitative reasoning should be adopted by teachers in all middle basic education schools in Enugu State.
2. Nigerian teacher education curriculum should emphasize the use of computer aided instruction in microteaching and teaching practice exercises to avail teachers more practical knowledge during their training.
3. Periodic workshops and seminars should be organized for quantitative reasoning teachers on use of computer aided instruction for teaching quantitative reasoning.

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