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INNOVATIVE INSTRUCTIONAL STRATEGIES AND SENIOR SECONDARY STUDENTS' ACHIEVEMENT IN ALGEBRA

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Abstract:
Innovative instructional strategies utilization effects on the senior secondary students' algebra achievement in Rivers State was investigated in this study. The design adopted for the study was the pretest-posttest quasi – experimental design type. The sample of 76 schools used for the study were purposively selected while 398 students were selected randomly from intact classes and used for the study. The research was guided by two research questions and two hypotheses. Algebra Achievement Test (AAT) with 0.80 reliability coefficient was the instrument used for data collection. The statistical tools used for data analysis were mean, standard deviation and analysis of covariance. Findings indicated significant difference in the achievement mean scores of students based on strategy but not based on gender. Therefore, utilizing innovative instructional strategies by Mathematics teachers shall ensure effective and equitable teaching and learning of algebra in the secondary schools.

Keywords: Innovative, instructional strategy, students, algebra, achievement

1. Introduction

The term strategy implies thoughtful planning of classroom instructional process. Instruction or teaching strategy therefore refers to thoughtful planning of the instructional process to ensure effectiveness. Awotua-Efebo (2007) defined teaching strategies as all those teaching methods available to a teacher during the teaching process for communicating ideas, knowledge, skills, attitudes, etc., to the students so that at the end of instruction, the students can behave in the manner stated in the objective for the lesson. Instructional strategy enables students to focus their attention on learning for

better understanding and help teachers to provide a suitable platform for strategic learning. It is an integral component of the lesson planning. Instructional strategy could be broadly classified into innovative and conventional.

1.1 Innovative Instructional Strategy

Innovation is the use of new and improved knowledge, ideas, methods, processes, tools and machinery to enhance products and services (Ajaja, 2007). Innovation is said to be the mother of inventions. Therefore, innovative instructional strategy refers to a learning strategy with new and improved knowledge and processes in its design. Selected innovative instructional strategies are briefly defined below:

Brainstorming

This is an instructional strategy that requires identifying and gathering facts, terms and ideas from memory that are related to the topic or problem by group members spontaneous contribution with the aim of finding a conclusion for a specified problem.

Peer learning

This is an instructional strategy that consists of pairing students together to learn or practice an academic task. The pairs of students can be of the same or differing ability and /or age range. Peer learning, peer tutoring, peer-led team learning, peer collaboration or peer assisted learning are used synonymously. Peer tutoring encompasses a variety of instructional approaches including cross-age tutoring, class wide peer tutoring and reciprocal peer tutoring. The leader of the group called the tutor is usually a more knowledgeable other while other members of the learning group are called the tutee.

Simulation-based learning

To simulate means to imitate or to reproduce a social, physical activity or hypothetical activity in order to arrive at a solution. Simulation is a representation of a condition or process in different medium such as a computer, chart or mock-up for the purpose of learning. Awotua-Efebo (2007) defined simulation as a representation of a selected aspect of social and physical reality with which students may interact. This representation, according to him can take the form of drama (role-playing) or through the use of computer. The use of the computer in simulating has made the traditional simulation method of learning conventional. Simulation-based learning is a learning strategy for representing a dynamic real world system by a model and experimenting with the model in other to gain information about the system. The strategy develops in the learner the problem solving skills.

Cooperative learning

It is a learning strategy in which students are arranged to work in groups and are rewarded on the basis of the success of the group. It is a structured form of group work where student-student or teacher-student interaction target the task to be learned, the

materials that comprise the structure of learning activity and the role expectations and responsibilities of individuals within their groups. Members of the group pursue common goals while being assessed individually. Cooperative learning forms attitudes and values, provides models of pro-social behavior, presents alternative perspectives and viewpoints, builds a coherent and integrated identity and promotes critical-thinking, reasoning, and problem solving skills (Gary, 2011). Gary listed four cooperative learning types as follows: student teams-achievement division, teams-games-tournaments, jigsaw II, and team-assisted individualization.

Group learning

Learning that takes place among large number of students is regarded as group learning.

Experiential learning

This is a learning process that encourages students' application of knowledge and conceptual understanding to real-life problems with the guidance of an instructor or learning facilitator. The classroom, laboratory, or studio can serve as setting for experiential learning through embedded activities such as problem solving, simulation, experiment or art project (Wurdinger & Carlson, 2010). Mathematics requires experiential learning where students are involved in their own understanding of mathematical concepts and practices. The dream of applying Mathematics to solving real–life problems can be realized through experiential learning.

Cognitive apprenticeship

This is a learning process where a master of a skill teaches that skill to an apprentice. The goal is to help students generalize the skill, to learn when the skill is or is not applicable and to transfer the skill independently when faced with novel situations. Cognitive apprenticeship can also be defined as learning through guided experience on cognitive and metacognitive rather than physical skills and process.

Guided learning

Is an instructional sequence for small groups which is integrated into lessons to provide a bridge between whole-class teaching and independent work. It is direct teaching and works best when students are acquiring and developing concepts or skills in a subject.

Inquiry learning

Inquiry learning arranges instruction to emphasize how things are organized, how they change and how they interrelate, within which concept learning may be part of the larger inquiry process. The inquiry learning approach leads to alternative paths and solutions in the process of exploring and discovering new information about a topic (Gary, 2011). Inquiry learning places student's questions, ideas and observations at the centre of the learning experience (Nwosu, 2008).

Active learning

A learning strategy in which learners actively engaged in the instructional process rather than passively absorbing lectures. Active learning include: peer learning, problem-based learning, cooperative learning, collaborative learning, think-pair-share learning etc.

Game-based learning

An educational game is a game designed to teach humans about a specific subject and to teach them a skill. Games are interactive; it is a play that teaches us goals, rules, adaptation, problem solving etc. Learning by gaming is game-based learning. Mathematical games are multi-player games designed to teach specific mathematical skills, concepts, topics and contents. Some examples of mathematical games are ludomatics and tic-tac-toe.

Interdisciplinary teaching

Planned teaching in which topics are integrated to focus on specific theme.

Technology-based learning

This is technology driven instructional strategies. Examples are ICT-based learning, computer-assisted learning, e-learning etc.

Mastery learning

This is a teaching strategy build on the principle that all students can attain lesson and unit objectives if given appropriate teaching and enough time to learn. Students master each lesson unit before progressing to learning the next unit of lesson. The level of mastery of content attained by the learner is depending on the time actually spent learning the material and the time the student needs to master the material. It is represented mathematically thus;

$$\text{Degree of learning by a student} = f\left(\frac{Time\ spent}{Time\ allowed}\right).$$

Learning trajectory

Describes method of learning whereby the learners refine their understanding of specific idea into robust concepts with time and by the effect of instruction. Mathematics learning trajectories are currently viewed as promising tools for students learning improvement.

Collaborative learning

This is an instructional method in which the students team together on an assignment. Each individual contribute his/her knowledge and skill towards achieving the common goal of the team with the team members learning from one another. Collaborative learning can be viewed as encompassing all group-based instructional strategies including cooperative and peer learning.

Laboratory-based learning

Laboratory-based learning denotes a practical oriented learning in an environment conducive to meaningful, deep learning by challenging students to problem-solving through hands-on experience. Laboratory-based learning promotes active learning, effective decision making through critical thinking, and when working in small groups can further develop students' cooperative skills. There are two types of laboratory-based learning namely laboratory activity-based learning and laboratory demonstration-based learning.

Problem-based learning

Problem-based learning is a classroom instructional strategy that organizes instruction around problem solving activities and affords students more opportunities to think critically, present their own creative ideas and communicate with peers mathematically. Emmanuel (2009) defined problem-based learning as an instructional strategy in which complex problems rooted in real life or world situation are used to motivate learners into discovering important concepts; their interconnections and making generalizations.

Concept mapping

A learning strategy intended to represent meaningful relationship between concepts. It is a diagrammatic conceptual representation of knowledge structures as related to one another. It is also the technique for visualizing the relationship among different concepts.

Activity-based learning

Activity based learning is a strategy which focuses teaching on practical learner activities designed to bring about learning experience and outcome through active participation.

Computer-assisted instruction

This is a teaching process that uses a computer in the presentation of instructional materials, often in a way that require the student to interact with it. Also, it refers to instruction presented on a computer. Computer programs are interactive and can illustrate a concept through attractive animation, sound and demonstration. They allow students to progress at their own pace and work individually or solve problem in a group.

Integrated learning system

A type of technology-based learning designed to deliver, manage, monitor measure and assess learning content.

Learning management system

This is a software application for the administration, documentation, tracking, reporting and delivery of educational subjects or training programs. They help the instructor

deliver materials to the students, administer tests and other assignments, and track student's progress, and manage record keeping.

Field trip learning

A planned visit to a place outside the usual classroom for an instructional purpose. Trips to national mathematical centre, mathematics laboratories, industries etc. could afford students the opportunity to appreciate the practicability and applicability of mathematics in real world.

Design-based learning

This is a type of project-based learning which provides tools and techniques for teaching students basic skills and knowledge from any subject so that they learn how to think critically at the highest level to invent, extrapolates, adapt and transform information.

Metacognitive learning

Metacognition is a mental process that enabled learners reflect on their thinking by internalizing, comprehending and remembering the content to be learned. Metacognitive learning strategy describes a process designed to help students think about their thinking.

Constructivist learning strategy

Constructivism is a philosophy or theory of learning founded on the premise that by reflecting on our experiences, we construct our own understanding of the world we live in. Each of us generates our own rules and mental model which we use to make sense of our experiences. Constructivism deals with designing and sequencing learning to allow learners apply their experiences in constructing actively meaning that make sense to them instead of obtaining knowledge through the teacher organized format. Constructivist learning strategies describes an instructional process that emphasize the learner' direct experience and classroom dialogue by active participation. Dougiamas (1998) described the major faces of constructivism to include trivial, radical, social, cultural and critical constructivism.

Constructionist learning model

Constructionist learning theory posits that learning is seen as involving internal process of construction of mental models in which children attempt to resolve personal conflicts or differences between their existing ways of thinking and the aspects of their experiences that are new in order to acquire the knowledge of the world around them (Odili, 2006). Although individual personal construction is central, interacting with others creates opportunities in which learning occurs. The resolution of conflicts that result when different points of view are proposed creates situations in which learning may occur. From a constructionist perspective, learning mathematics is viewed as a process in which

students reorganize their activities to resolve situations found to be personally problematic or, difficult (Comfrey, 1987; Von Glasersfield, 1987 in Odili, 2006).

Vee mapping

Is a learning tool developed to guide students thinking and learning during laboratory practical instruction. That is, it helps students to understand how new knowledge is attained in an experimental situation.

Teaching for understanding

This technique helps educators take students beyond the simple mastery of facts to being able to apply knowledge flexibly in unfamiliar contexts. It help educator to identify topics, concepts, and skills that are worth understanding. Also it engages students in challenging learning experiences that help to build and demonstrate their understanding.

Mind mapping

Is a simple technique for drawing information in diagrams, instead of writing it in sentences. The diagrams always take the same basic format of a tree, with a single starting point in the middle that branches out, and divides again and again. In other word, it is a concept mapping tool that structures concepts or information for better understanding. The factor and probability tree diagrams are examples of mind mapping instruction in Mathematics.

Just-in-time teaching

A learning strategy designed to promote the use of class time to ensure more active learning. Students respond to assignments which are due shortly before class and the teacher reads students' responses just-in-time to adjust the lesson to meet the learning needs of the students. Students can also respond to this assignment electronically.

ICT-based learning

This refers to any method of delivering learning materials through information and communication technology. Examples are web-based learning, computer-based learning, online and blended learning, tutorial learning, e-learning, video conferencing etc.

Model-lead test learning

This is an excellent strategy used in mathematics especially with older students. This strategy involves the teacher modeling the problem for student, leading them through the problem, and them testing them on what they have learned.

Diagnostic and remedial instruction

Diagnostic and remedial instruction is an instructional strategy in which a teacher observes each learner's progress, identify learning difficulties and adopt remedial measures or teaching to remedy the difficulties. Remedial instruction targets the basic or

foundational skills the child needs to master. This is important to help her make progress with more advanced skills and concepts. Some remedial approaches include breaking tasks down into smaller chunks, re-teaching skills and using a different teaching approach that may be a better fit for the way a student learns.

Team-based teaching

Team-based teaching or simply team teaching is a collaborative teaching approach involving two or more teaching personnel. The teachers are assigned parts or the whole course or subject contents to teach the students with each teacher assessing the students on the part taught. It also involves different teachers teaching different group of students the same course and contents with all the groups of students being assessed the same way-the same examination.

Think-pair-share

This learning activity requires students thinking about a topic or an answer to a problem individually then sharing ideas with one or more peers or during a formal class discussion. During this formal discussion, the instructor clarifies misconceptions.

Flipped classroom

This is modernized individualized instruction where instructional contents are delivered online-outside of the classroom. It is a form of blended learning with students learning through online lectures, collaborating in online discussions and video conferencing while at home-outside the classroom with the guidance of an instructor.

1.2. Conventional Instructional Strategies

Conventional instructional strategies are the commonly utilized strategies by teachers for instructional delivery. They are also known as the traditional teaching methods because they have stood the test of time. Some conventional instructional strategies have been explained briefly below:

Problem-solving learning

Problem-solving is a process that requires the learner to sift through previously acquired knowledge, and select an appropriate plan in solving the problem (Odili, 2006). Therefore problem-solving learning strategy requires the teacher to select an appropriate plan or model of teaching the learner how to solve problem. Some examples are Polya and Schoenfield problem-solving learning strategies.

Role play

This is an instructional approach where learning experiences are designed along roles the learners play during learning activities.

Project-based learning

Learning strategy which organize instruction around learning tasks that promotes and encourage intrinsic motivation, interest, effort and persistence among learners. It emphasizes learning activities that are long-term, interdisciplinary and student-centered.

Individualized instruction

Individualized instructional also known as differentiated instruction refers to classroom instructional method which maximizes each leaner's academic performance by reaching the learner he/she is and providing instruction and learning materials to meet the needs of the learner and to help him/her rise to the next level on the academic ladder.

Observational learning

It is learning which occurs from watching, retaining and replicating behaviour observed from a model. Observational learning can produce new behaviour and either increase or decrease the frequency with which a previously learned behaviour is demonstrated.

Discussion methods

Students-students or teacher-students open-ended collaborative share of ideas with the aim of promoting thinking, learning, problem solving, understanding etc.

Assignment-based learning

Assignments are academic problems given to students before or after instruction. Thus, there are pre-lesson and post-lesson assignments. Pre-lesson assignment enable students study the lesson to be taught before the actual teaching by the teacher while the post-lesson assignment provides opportunity for the learner to solve more practical problems leading to mastery of the concepts learnt. This is a common strategy of teaching and learning Mathematics.

Lecture method

Is the oldest teaching method applied in educational institution. This teaching method is a one way channel of communication of teaching. Student's involvement in this teaching method is just to listen and sometimes pen down some notes if necessary during the lecture, combine the information and organized it. According to Odili (2006), lecture method has three stages; definition of the terms, concepts, expressions or symbols which form the subject of lecture, explanation of the definitions just mention and summary that brings all the components together. Lecture method can be better used in introducing topics and defining concepts in a mathematics lesson. It should be used with other major methods of teaching Mathematics like problem solving and problem-based learning.

Questioning learning strategy

A question is an interrogative statement or expression often used to test knowledge. Questioning is natural and intuitive. Teacher ask question from the start of the lesson

until the end. Questioning forms part of any lesson because it invites the student to think even within a lecture style lesson. Teacher used questions to engage the students and sustain an active style to the learning. Questions are classified into convergent, divergent, reflective and evaluative.

Inductive learning

Induction is reasoning used to draw a conclusion or make a generalization from specific instances. Therefore inductive learning requires teaching concepts from real to abstract, particular to general and from example to formula. This is learning by induction-establishing a universal truth by proving that it is true for a particular case and further true for a reasonably adequate number of cases, hence, it is true for all such cases. A formula or generalization is thus arrived at through a convincing process of reasoning and problem solving. After a number of concrete cases have been understood, the learner successfully attempts generalization. Also it makes use of student "noticing" instead of explaining a given concept and following this explanation with examples, the teacher presents students with many examples showing how the concept is used.

Deductive learning

Deduction is defined as reasoning that proceeds from principles or generalizations to their application in specific instances (Gary, 2011). Therefore, deductive learning takes place from abstract to real, general to specific and from the formula to the example. It is a more teacher-centered approach where the teacher gives the students practice using the concept. For example, when teaching a new mathematical concept, the teacher will introduce the concept and the formula, explain the rules related to its use, and finally the student will practice using the concept and the formula in a variety of different ways. Mathematics lesson revisions are better done by deductive learning.

Analytic-synthetic learning

Analytic learning proceeds from unknown to known while synthetic learning proceeds from known to unknown.

Direct instruction

This is a teacher-centered, knowledge acquisition, presentation-recitation model for teaching facts, rules and action sequences (Gary, 2011).

Discovery learning

It is an active process of inquiry based instruction that encourages learners to build on prior knowledge through experience and to search for new information and relationship based on their interests. Awotua-Efebo (2007) defines discovery learning as one of the teaching methods for developing problem-solving skills in students in which once the teacher has given the students the instructional objectives, or a problem to solve, allows

them to achieve the objective with little or no guidance. Guided and unguided discovery are the two types of discovery learning.

This study therefore seeks to determine the effectiveness of the innovative instructional strategies over the conventional.

2. Statement of the Problem

Students' abysmal performance in Mathematics is attributed to many factors including poor pedagogy. Pedagogy which is the process of teaching younger learners requires the utilization of instructional materials and methods for effective teaching. These materials and methods are classified as conventional and innovational. Ogunkunle (2007) reported that Mathematics teachers in schools in Port Harcourt teach their students using the conventional methods. This study is therefore seeking to determine the relative effectiveness of the innovative instructional methods or strategies in Mathematics teaching and learning.

2.1 Aim and Objectives of the Study

The aim of the study is to determine the effects of innovative instructional strategies on the senior secondary student achievement in Algebra. Specifically the study shall determine:

1) The difference in the achievement mean scores of students taught algebra using innovative and conventional instructional strategies respectively.
2) The difference in the achievement mean scores of the male and the female students aught algebra using innovative instructional strategies.

2.2 Research Questions

The following research questions shall guide the study:

1) What is the difference in the achievement mean scores of students taught algebra using innovative and conventional instructional strategies respectively?
2) What is the difference in the achievement mean scores of the male and the female students taught algebra using innovative instructional strategies?

2.3 Hypotheses

Two null hypotheses shall be tested at 0.05 level of significance in this study.

$H0_1$: There is no significant difference in the achievement mean scores of students taught algebra using innovative and conventional instructional strategies respectively.

$H0_2$: There is no significant difference in the achievement mean scores of the male and the female students taught algebra using innovative instructional strategies.

3. Methodology

3.1 Research Design

The study adopted the pretest-posttest quasi-experimental research design. Students in the control group were taught with the conventional instructional strategies while students in the experimental group were taught using the innovative instructional strategies.

3.2 Population of the Study

The population of the study comprised all the 68,493 students from the 247 public senior secondary schools in Rivers State (RSSSB, 2017).

3.3 Sample and Sampling Technique

A sample of 398 senior secondary class two (SSC2) students obtained from the population by Taro Yamane formula was selected by simple random sampling technique while purposive sampling was used to select sample of 76 schools for the study.

3.4 Instruments for Data Collection

Algebra Achievement Test (AAT) consisting of 20 items was the instrument used for data collection. AAT was used to measure the academic achievement of students in algebra. The instrument was made up of section A and B. Section A was designed to collect students demographic data while section B constituted 20-item multiple choice Algebra Achievement Test with options A-D.

3.5 Validation of Instrument

The AAT was subjected to both content and face validity. Three specialists in mathematics education validated the instruments. Their correction and inputs were effected accordingly prior administration to the sample.

3.6 Reliability of Instrument

The reliability coefficient was determined using test-retest method. AAT was administered to 40 students who were not part of the study sample. After two weeks, AAT was re-administered to the same students. The first and second scores were correlated and 0.80 correlation coefficient was obtained for AAT indicating a high positive correlation index.

3.7 Method of Data Collection

AAT was administered to the senior secondary class two (SSC2) students by their mathematics teachers before and after instruction in algebra. The first scores collected were the pre-test scores while the second scores served as post-test scores. The AAT post-test was administered to the students taught by the conventional instructional strategies

and those taught by the innovative instructional strategies to obtain the posttest scores after four weeks of instruction.

3.8 Experimental Procedures

Intact classes were used with the students' usual mathematics teachers teaching algebra as contained in the senior secondary class two mathematics education curriculum for third term. Students in the experimental group were taught by their teachers using selected Innovative Instructional Strategies (IIS) while students in the control group were taught by their teachers using selected Conventional Instructional Strategies (CIS). Having identified the type of instructional strategies used by each teacher which was classified into innovative and conventional, they were encouraged to use the strategies to teach the students. The teachers had knowledge of the particular strategy they utilized for the instruction. The teaching lasted for six weeks while the researcher monitors some of the instructional processes to ensure compliance. The contents of algebra taught includes: quadratic equation, simultaneous linear and quadratic equations, gradient of a curve, logical reasoning, and linear inequalities.

3.9 Method of Data Analysis

The data collected from the respondents for this study were analyzed using SPSS (version 21) software. The research questions were analyzed using mean and standard deviation while the hypotheses were tested using analysis of covariance (ANCOVA).

4. Results

4.1 Answering Research Questions

Research Question 1: What is the mean difference in the achievement of students taught algebra using innovative and conventional instructional strategies respectively?

Table 1: Mean and standard deviation on the difference in the achievement of students taught algebra using innovative and conventional instructional strategies respectively

		Pretest		Posttest		Gain	
Group	**N**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
CIS	194	21.24	5.40	42.23	8.94	20.99	7.14
IIS	204	21.71	6.35	63.65	14.60	41.94	14.40

Key: CIS= Conventional Instructional Strategies, IIS= Innovative Instructional Strategies

Table 1 showed mean and standard deviation on the difference in the achievement of students taught algebra using innovative and conventional instructional strategies respectively. It showed that the students taught with conventional instructional strategies have a mean gain score of 20.99, SD=7.14 while students taught with innovative instructional strategies have a higher mean gain score of 41.94, SD=14.40.

Research Question 2: What is the mean difference in the achievement of the male and the female students taught algebra using innovative and conventional instructional strategies respectively?

Table 2: Mean and standard deviation on the difference in the achievement of the male and female students taught algebra using innovative instructional strategies

			Pretest		Posttest		Gain	
Group	**Sex**	**N**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
CIS	Male	120	21.13	5.31	41.93	8.91	20.80	6.92
	Female	74	21.41	5.58	42.70	9.03	21.30	7.51
IIS	Male	108	22.11	5.88	66.22	14.78	44.11	14.38
	Female	96	21.25	6.85	60.75	13.91	39.50	14.10

Table 2 showed the mean and standard deviation on the difference in the achievement of the male and female students taught algebra using innovative and conventional instructional strategies respectively. It showed that the male students taught with CIS had a mean gain score of 20.80, SD=6.92 and the female had a mean gain score of 21.30, SD=7.51 while the male taught with IIS had a mean gain score of 44.11, SD=14.38 and the female had a mean gain score of 39.50, SD=14.10. This implies that the male and female students taught with IIS out performed those taught with CIS.

4.2 Test of Hypotheses

H_{01}: There is no significant difference in the achievement mean score of students taught algebra using innovative and conventional instructional strategies respectively.

Table 3: Summary of ANCOVA on the difference in the achievement mean score of students taught algebra using innovative and conventional instructional strategies respectively

Source	**Type III Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Corrected Model	53293.351[a]	2	26646.676	206.285	.000
Intercept	38018.482	1	38018.482	294.320	.000
PRETEST	7668.854	1	7668.854	59.368	.000
GROUP	44078.992	1	44078.992	341.237	.000
Error	51023.755	395	129.174		
Total	1231008.000	398			
Corrected Total	104317.106	397			

a. R Squared = .511 (Adjusted R Squared = .508)

Table 3 showed the summary of ANCOVA on the difference in the achievement mean score of students taught algebra using innovative and conventional instructional strategies respectively. The result showed that there is a significant difference in the achievement mean score of students taught algebra using innovative and conventional instructional strategies respectively ($F_{1,395}$=341.237, p=0.000). The null hypothesis was rejected at .05 alpha level.

H_{02}: There is no significant difference in the achievement mean score of the male and female students taught algebra using innovative instructional strategies respectively.

Table 4: Summary of ANCOVA on the difference in the achievement mean score of the male and female students taught algebra using innovative instructional strategies

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	9224.146[a]	2	4612.073	19.158	.000
Intercept	35475.724	1	35475.724	147.360	.000
PRETEST	9195.275	1	9195.275	38.196	.000
SEX	9.787	1	9.787	.041	.840
Error	95092.960	395	240.742		
Total	1231008.000	398			
Corrected Total	104317.106	397			

a. R Squared = .088 (Adjusted R Squared = .084)

Table 4 showed the summary of ANCOVA on the difference in the achievement mean score of the male and female students taught algebra using innovative instructional strategies. The result indicated that there is no significant difference in the achievement mean scores of the male and the female students taught algebra using innovative instructional strategies ($F_{1,395}$=0.41, p=.840). The null hypothesis was upheld at .05 alpha levels.

5. Discussion of Findings

This discussion shall be made under the following headings:

5.1 Students achievement when taught algebra using innovative and conventional instructional strategies respectively

Findings from this work established that there is a significant difference in the achievement means scores of students taught algebra using innovative and conventional instructional strategies respectively. This implies that students taught algebra using some innovative instructional strategies out-performed their fellow students in the conventional group. Khurshid & Ansari (2012) investigated the effects of innovative instructional strategies on grade one students' performance and obtained similar result.

5.2 The male and female students achievement when taught algebra using innovative instructional strategies

The study revealed that the difference in the achievement mean scores of the male and the female students taught algebra using innovative instructional strategies was not significant. It implies that the improvement in the performance of students taught with innovative instructional strategies is not gender based but is determined by the instructional strategies employed in teaching the students. Lazzear (2014) finding that students' achievement did not depend on gender but on the teaching strategy among

others, agrees with the finding of this study. On his part, Elvis (2013) revealed that teacher-student interactive method was the most effective teaching method, followed by student-centered method while teacher-centered approach was the least effective instructional method.

5.3 Conclusion

Innovative instructional strategy refers to a learning strategy with new and improved knowledge and processes in its design. Findings from this study revealed that the use of innovative instructional strategies in Mathematics teaching and learning enhances the performance of students and promotes gender parity in Mathematics.

5.4 Recommendations

Recommendations from this study are as follows:

1) Mathematics teachers at the secondary level of education should seek to acquaint themselves with the knowledge of innovative instructional strategies through self-study, attending workshops, seminars and conferences.
2) Teachers should endeavor to utilize different innovative instructional strategies in teaching Mathematics at the secondary school because they improve the academic performance of the male and the female students.

References

Ajaja, O. P. (2007). *Teaching method across discipline.*Agbor. Allwell publication.

Awotua-Efebo, E. B. (2007). *Effective teaching: Principles and practice.* Port Harcourt: Paragraphics.

Comfrey, M. (1987). Linking language to action in Miles. *Dyslexia and Mathematics,* London, Rutledge, 42-57.

Dougiamas, M. (1998). A journey into constructivism. Retrieved on April 12, 2017 from http://www/thirteen.org/edonline/concept2class/constructivism/index.html.

Elvis, M. G. (2013). Teaching methods and students' academic performance. *International Journal of Humanities and Social Science Invention,* 2(9), 2319 – 7722, Retrieved September 9, 2013 from https://www.researchgate.net/publication.

Emmanuel, E. O. (2009). Problem based learning tool for developing entrepreneurial skills in mathematics. In Nsika-Abasi Udofia (ED), developing entrepreneurial skills through science, technology and mathematics education. 50th Annual conference of the Science Teachers Association of Nigeria Minna, STAN (254-258).

Gary, D. B. (2011). *Effective teaching methods: Research-based practice.* Boston: Pearson Education, Inc..

Nwosu, A. A. (2008). *Effects of guided-inquiry and demonstration science process skills acquisition among secondary school biology students*. *J. Sci. Teach. Assoc. Niger.* 38(102),58-63

Odili, G. A. (2006). *Mathematics in Nigeria secondary schools: A teaching perspective*. Port Harcourt: Rex Charles & Patrick Limited.

Ogunkunle, R. A. (2007). Constructivism: An instructional strategy for sustaining students' self-concepts in senior secondary school mathematics. *Journal of the Science Teachers Association of Nigeria*, 41, 30 – 50.

Rivers State Senior Secondary Schools Board (2017). Local Government Area breakdown of students enrolment for 3rd term 2015/2016 session.

Von-Glasersfield, U. (1987). 'Research council report: Significant ideas in diagnosis. *Focus on Learning Problems in Mathematics* 9(3), 43-58.

Wurdinger, S. D. & Carlson, J. A. (2010). *Teaching for experiential learning*, Rowman & Little field education Inc. United State of America. Retrieved on April 12, 2017 from http://www.rowmaneducation.com