

# Effects Of Video-Based Cooperative, Competitive And Individualized Instructional Strategies On The Performance Of Senior Secondary Schools Students In Geometry

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## ABSTRACT

This study examined the effects of video-based cooperative, competitive and individualized instructional strategies on the performance of senior secondary schools' students in geometry in Nigeria. It also examined the influence of gender on students' achievement. Pretest, posttest, experimental control group design was adopted for this study. Purposive sampling technique was used to select four secondary schools based on some criteria. 120 second year mathematics students were randomized from four co-educational schools in Minna, Nigeria. The students were assigned into cooperative, competitive, individualized, and conventional groups. Video-based instructional package on Geometry concept in Mathematics was used as treatment instrument, while Geometry Achievement Test (GAT) was employed as test instrument. Analysis of Variance, Scheffe post hoc test, and t-test statistics were used for data analysis. Findings revealed that there was significant difference in the performance of the groups in favour of cooperative group. In addition, students' gender had no influence on students' performance in cooperative and individualized groups. However, male performed better than female in competitive instructional strategy. Based on the findings, it was recommended that mathematics teachers should employ video-based cooperative instructional strategy for improving students' performance in the subject..

**Keywords:** *Cooperative, Competitive, Individualized, Conventional Teaching Method, Video Instructional Package, Geometry*

## INTRODUCTION

The importance of Mathematics in science is well recognized. Mathematics has always been a core subject in the senior secondary school curriculum in Nigeria. The central role played by Mathematics in all areas of Science and Technology, necessitates the importance of providing secondary school students with a sound and wide mathematical background (FRN, 2013). Students seeking entry into tertiary institutions in Nigeria are expected to be competent in mathematics and passed it at credit level. Students at this level must not acquire only empirical but also abstract understanding of mathematics. With the increasing emergence of new technology and innovative teaching techniques, new challenges are generated for teachers (Too, 2007).

In this 21<sup>st</sup> century, there are tremendous changes in teaching and learning of mathematics in the epistemology, assessment and technology advancement. The major transformation is that teaching and

learning is no longer a one-way process but is a shared responsibility between the instructor and the students (Krishnan, 2016). Learning require an active process which includes student participation, engagement and involvement in the learning process. Presently, the teaching and learning environment has changed from teacher-centred to learner centred using technology to enhance effective learning. One of such technological tools is video-based instruction.

The potential of visually representing abstract mathematical ideas appears to offer promise to educators who realize the video-based instruction capabilities. Video-based instruction offers great potential for science, technology and mathematics education (Gambari & Zabairu, 2008; Gbodi & Laleye, 2006). Using video-based instruction with sophisticated graphics and illustration can be created to present mathematics topics in ways that are not possible within the confines of the traditional textbook and lecture format (Adebayo, 2008). Therefore, this study used video to support cooperative, competitive, individualistic and conventional teaching respectively. Cooperative Video Instructional Package (COOVIP) was developed for students in cooperative learning environment, Competitive Video Instructional Package for those in competitive class, Individualized Video Instructional Package for those in individualized setting, while Conventional Video Instructional Package was employed on students in conventional classroom.

The nature of instruction in Nigerian classrooms is a one-way process in which the teacher directly presents information and skills dictated by a textbook. In this approach students generally remain passive throughout a lesson. Failure to utilize appropriate teaching methods combined with technological tools while teaching led to persistent poor performance in science, technology and mathematics at senior secondary school certificate examination (SSSCE) in Nigeria (Adegoke, 2011; Gambari, 2004; Taiwo, 2008). Furthermore, how students perceive each other and interact with one another is a neglected aspect of instruction. In most cases teacher-student interaction is encouraged but student-student interaction is relatively neglected. This can create a competitive environment and produce a passive attitude toward learning as students vie for the teacher's approval (Gambari, 2010; Harman & Nguyen, 2010; Killen, 2007). Killen (2007) defines cooperative learning as an instructional design that stimulates peer interaction and learner-to-learner cooperation in the process of fostering successful learning by all.

Empirical evidence have revealed that teachers in Nigerian school system seldom use other teaching methods aside conventional method, this approach has persistently not yielding desire result. Hence, the need to explore other strategies of teaching, the present study therefore set to empirically find out the effects of cooperative video instructional strategy on students' performance in geometry.

## LITERATURE REVIEW

Studies on cooperative, competitive and individualized learning had generated a lot of controversy in the late 1980s. The end product of cooperative learning is higher achievements of individual as compared to competitive or individualistic efforts demonstrated by hundred of studies as revealed by Johnson (2000). Recently, the cooperative learning was found to be advantageous on academic achievement in English, Mathematics and Science subjects (Gambari, 2010; Kumari & D'Souza, 2011; Ning & Hornby, 2010; Thangarajathi & Viola, 2007; Topping, Thurston, Tolmie, Christie, Murray, & Karagiannidou, 2011; Yusuf, Gambari & Olumorin, 2012). Furthermore, cooperative learning facilitates greater improvement in students' performance and self-esteem than does competitive or individualistic learning environments (Johnson & Johnson, 2005).

The researchers have argued about the superiority and effectiveness of cooperative learning over competitive and individualistic learning on different grounds. Face-to-face interaction, positive interdependence, individual accountability, interpersonal and collaborative skills, and group processing are the five elements essential for increasing the likelihood of success of the co-operative learning endeavour (Slavin, 2005). According to Slavin (1983), the success of co-operative learning is highly dependent on the underlying incentive of reward structure. Similarly, Lawrence (2006) examined achievement in individually, competitively and cooperatively reward-structured environments in two high-school biology classrooms. The finding of that study revealed that the two groups were not significantly different from each other on the pretest. While both cooperative and competitive techniques obtained significantly higher posttest scores,

neither treatment was superior over the other in producing academic achievement. The study of Martin and Roland (2007) confirmed the finding of Lawrence (2006). They compared the effects of cooperative learning method of jigsaw and traditional direct instruction method on the cognitive achievement in physics. Analysis of the result revealed no significant differences between the two groups of instruction in students' cognitive achievement in physics

On a general note, Samuel and John (2004), Gupta and Pasrija (2012), Ajaja and Eravwoke (2010), Melihan and Sirri (2011), Yusuf, Gambari and Olumorin (2012) and Zakaria, Solfitri, Daud and Abidin (2013) concluded that the cooperative learning method is more effective than the traditional teaching method in the academic success of students. Empirical studies on the use of video to support cooperative, competitive, and individualized learning are uncommon. However, students using CAI in cooperative learning settings performed better than students using the same programme individually (Fajola, 2000; Gambari, 2010; Yusuf & Afolabi, 2010). Nkebem and Okon (2006) reported a significant differential effects on academic achievement and attitude towards library skills when cooperative, competitive and individualistic groups were exposed to Self-Instructional Method.

Studies have shown differences between male and female students' performance in the past few decades on standardized test. For instance, Hyde and McKinley (1997) opined that the more exposure female are getting to mathematics and science classes, the better their scores. Kolawole (2007) found that boys performed better than girls in both cooperative and competitive learning strategies when he conducted a research on the effects of competitive and cooperative learning strategies on Nigerian students' academic performance in mathematics. Work by Eccles, Lord, Roeser, Barber, and Jozefowicz (1997) found that gender differences in enrollment in advanced mathematics courses in high school are mediated by gender differences in expectations for success in math and physics and perceived value of competence in mathematics. Aguele and Uhumniah (2008); Billings (2000) and Croxford (2002) found, in their studies at various times, that male students achieved significantly better than female students in science education. Viann (2002) reported no significant gender-related differences when individualized learning method with three treatment sections using cooperative learning strategy on mathematics were used, but females achieved slightly higher than males. Tharp-Taylor and Nelson-Le (2005), Orabi (2007), Adeyemi (2008), Ifamuyiwa and Akinsola (2008), Annetta, Mangrum, Holmes, Collazo and Cheng (2009), Kost, Pollock and Finkelstein (2009) and Yusuf and Afolabi (2010) reported no significant difference between male and female students taught using cooperative learning strategies. Similarly, Gambari (2004), Gambari (2010) and Viann (2002) and Yusuf and Afolabi (2010) found no significant gender-related differences when students were exposed to individualized learning method.

### **THEORETICAL BACKGROUND**

Increasing students' independence of learning could give learners the opportunity to arrange their learning experiences effectively. There are three basic ways in which students can interact with each other as they learn. They can compete to see who is the "best," they can work individually towards a goal without paying attention to other students, or they can work cooperatively with a vested interest in each other's learning as well as their own. The preceding distinctions are in line with Deutsch (1947) position who actually provided foundation for the development of cooperative and competitive learning theory. Cooperative instruction is the situation in which there is a positive correlation between/among individuals' goal attainment: where an individual can obtain his own goal if and only if the other participants can obtain their goals. He defined competitive instructional mode as one in which the goal attainment of the separate participants is so linked that there is a negative correlation between their goal attainments (Nkebem & Okon, 2006).

Johnson and Johnson (1999) differentiated cooperative learning from competitive and individualistic learning on three bases. These are: goal, level and interaction pattern, evaluation of outcomes. In cooperative learning, the goal of class members is to learn the assigned material and to ensure that all other group members do likewise. On the level of interaction pattern, the cooperation may be extended to the class (by ensuring that everyone in the class has learned the assigned material) and to the school level (by ensuring

that all students in the school are progressing academically). Students promote each other's success. Students discuss material with each other, explain how to complete the assignment, listen to each other's explanations, encourage each other to work hard, and provide academic help and assistance. This interaction pattern exists between as well as within groups. The evaluation of outcomes is based on criteria-referenced assessment and evaluation system. The focus is usually on the learning and academic progress of the individual student but may also include the group as whole, the class, and the school.

In competitive learning, the goal of class members is structured to perform faster and more accurately than other classmates. The level of interaction pattern in competition may be focused on the group (by seeking to be the best learner in the group), the class (by seeking to be the best learner in the class), the school (by seeking to perform higher than anyone else in the school), and sometimes the nation (by seeking to perform higher than anyone else in the country). It cannot be extended to inter-group competition without it becoming in-group cooperation. Students obstruct each other's success. Students work alone, hide their work from one another, refuse to help or assist others, and may interfere with and seek to lower each other's efforts to learn. The evaluation of outcomes is based on non-referenced evaluation system. The focus of assessment and evaluation is on ranking students' academic performance from best to worst (Johnson & Johnson, 1999).

In individualistic learning, the goals of class members are structured to perform up to a preset criterion independently from classmates. The level and interaction pattern is that individualistic efforts focus on the person reaching a preset criterion of performance. Students do not interact with one another. Each works alone, independently from all others. The evaluation of outcomes is based on criterion - referenced evaluation system. The focus is on determining whether a student's academic performances reaches a preset criterion (Johnson & Johnson, 1999).

Slavin (1997) presented four major theoretical perspectives of cooperative learning as: (i) motivational, (ii) social cohesion, (iii) developmental, and (iv) cognitive elaboration perspectives. (i) Motivational perspective focused primarily on the reward or goal structures under which students operate. From this perspective, cooperative incentive structures create a situation in which the only way group members can attain their own personal goals is if all the members of the group are successful.

(ii) In social cohesion perspective, theorists emphasized the idea that students help their group mates learn because they care about the group. This theory is relevant when each individual's goals are accomplished under the influence of the actions of others (Johnson & Johnson, 2005). This perspective holds that students help each other learn because they care about the group and its members, and come to derive self-identity benefits from group membership (Slavin, 2011). Findings from research Johnson and Johnson (2009) show that the positive outcomes of social interdependence are identified as: effort to achieve, positive relationships and social support, and psychological health and self-esteem.

(iii) In developmental perspective, the theorists' assumed that interaction among children around appropriate tasks increases their mastery of critical concepts. Damon (1984) supports the viewpoint of cognitive development, and proposes a theoretical paradigm which combines the perspectives of Piaget and Vygotsky into peer co-operation, which explains why cooperative learning can improve student learning and achievement. This paradigm proposes "an educational program based on peer work" that can happen in cooperative learning activities with the following outcomes:

(a) They expose inadequate or inappropriate reasoning, which results in disequilibrium than can lead to better understanding.

(b) Through mutual feedback and debate, peers motivate one another to abandon misconceptions and search for better solutions.

(c) The experience of peer communication can help a child master social processes, such as participation and argumentation, and cognitive processes, such as verification and criticism.

(e) Collaboration between peers can provide a forum for discovery learning and can encourage creative thinking.

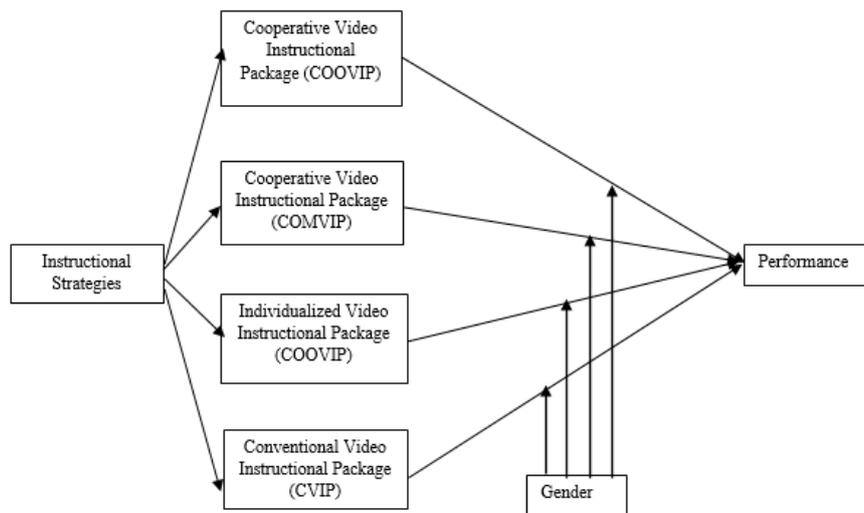
(e) Peer interaction can introduce children to the process of generating ideas. (Damon, 1984, p.335).

(iv) The cognitive elaboration perspective arose from the work of Piaget (1926) and Vygotsky (1978). A basic assumption of the cognitive development perspective driven by their theories, together with those of their colleagues, is that reciprocal interaction among children around suitable academic tasks creates growth in the knowledge of concepts and critical skills (Slavin, 2011). Piaget (1926) supports the cognitive developmental perspective, and argues that knowledge, values, regulations, morals and systems of symbols may only be learned effectively through interaction among participants. This has been identified by O'Donnell and O'Kelly (1994) and O'Donnell (2000). This viewpoint stresses the effectiveness of elaboration in the process of learning and thinking, and that elaboration prepares the individual for cognitive re-structure and rehearsal in order to enhance learning tasks (Slavin, 2011). Webb (1989) discovered that students achieve more knowledge and skills from engaging in cooperative activities when they offer more explanations to others. O'Donnell (1996) found that students working on structured cooperative scripts can learn material or procedures better than students working alone.

Another related theory is constructivist learning theory. Cooperative learning is a student-centered learning method; therefore, it ties outcomes with the constructivist learning theory in which "learners are in control of constructing their own meaning in an active way" (Almala, 2005, p.10). Therefore, one of the expectations for students involved in the treatment group in this study is that they are encouraged to play the role of active constructors of knowledge, and they may learn more when they are in control of constructing their own meaningful knowledge through reciprocal interaction among students on interactive learning tasks using video as a medium of instruction.

#### **CONCEPTUAL FRAMEWORK**

This study is based on the use of video-based cooperative, competitive, individualistic and conventional instructional strategies for enhancing academic performance of senior secondary school mathematics students. It involved identification of some difficult concepts in mathematics that were developed in simpler instructional module using video instruction platform. The concept in Geometry was identified as one of the difficult concepts in mathematics at senior secondary school level in Nigeria, the concept was broken into nine lessons from school curriculum. The contents were prepared, validated and recorded in video package and used in four different modes: (i) Cooperative Instruction Strategy, Competitive Instruction Strategy, Individualized Instructional Strategy, and Conventional Teaching Method respectively. The effects of video-based cooperative, competitive, individualistic and conventional teaching method on male and female students' performance in mathematics were determined. The students' academic performance produced the resultant effects to ascertain its integration into teaching and learning at secondary school level in Nigeria. The conceptual framework for the Study is shown in Fig. 1.



**Fig1: Conceptual Framework for the Study**

### STATEMENT OF THE PROBLEM

The performance of students in mathematics at secondary school level in Nigeria has been quite unsatisfactory over the years (NECO, 2015; WAEC, 2014). The poor performance of students in science particularly in mathematics as a subject has implications on university admission because schools no longer produce adequate number of students that passed mathematics at credit level for university admission. This problem was attributed to poor instructional methods and lack of integrating technology into teaching pedagogy. To improve students' performance in mathematics, students must be more active in the classroom and must creatively acquire knowledge, especially in understanding and solving mathematical problems. Students need opportunities to develop, interact, and share with friends through cooperative learning activity.

Few researches were carried out on the effects of technology-based cooperative, competitive and individualized instruction for teaching mathematics at secondary school level of education in Nigeria. However, various studies on technology enhanced learning were conducted in developed nations to determine its effectiveness in relation to learners' achievement. Literature revealed that video-based instruction is more effective than conventional teaching method. However, if the video-based instructions are not effectively used to highlight teaching points, it is hard to expect desirable effects. What may be extrapolated in this study is that, can video-based instruction be more effective in cooperative or competitive or individualized environments as compared to conventional video instructional settings? This study therefore examined the effects of video-based cooperative, competitive and individualized instructional strategies on the performance of senior secondary schools' students in geometry.

### RESEARCH HYPOTHESES

The following null hypotheses were formulated and tested at 0.05 level of significance:

- (i) There are no significant differences in the performance of students taught mathematics using COOVIP, COMVIP, IVIP.
- (ii) There is no significant difference in the performance of male and female students taught mathematics using COOVIP.
- (iii) There is no significant difference in the performance of male and female students taught mathematics using COMVIP.
- (iv) There is no significant difference in the performance of male and female students taught mathematics using IVIP.
- (v) There is no significant difference in the performance of male and female students taught mathematics using CVIP.

## METHODOLOGY

### *Research Design*

A pretest, posttest, experimental control group design was employed in this study. Four levels of independent variable (cooperative, competitive, individualistic and conventional method groups) and two levels of gender (male and female) were investigated on students' performance in Geometry. This design was adopted because the four groups involved have common variables (performance and gender). The design layout is as shown in Table 1.

**Table 1: Research Design Layout**

Groups	Pre-test	Treatment	Post-test
Experimental Group 1	O <sub>1</sub>	COOVIP	O <sub>2</sub>
Experimental Group 2	O <sub>3</sub>	COMVIP	O <sub>4</sub>
Experimental Group 3	O <sub>5</sub>	IVIP	O <sub>6</sub>
Control Group	O <sub>7</sub>	CVIP	O <sub>8</sub>

Table 1 shows the three experimental groups and the control group. Samples in the four groups were pre-tested using Geometry Achievement Test (GAT). The three experimental groups received the treatment using cooperative video instructional package (COOVIP) for group one, competitive video instructional package (COMVIP) for group two, individualized video instructional package (IVIP) for group three and the control group was exposed to conventional video instructional package (CVIP). After the treatment, all the groups were tested using a parallel version of the questions used for the pre-test as post-test.

The target population of this research was the second year senior secondary mathematics students in Minna, Nigeria. The nature of the study, however, required that the research sample was purposively selected. This is because a research using computer CDROM for playing the video package must necessarily be conducted in schools where computers are available for students' use and where the students are computer literate. This was why the Hill-Top Model Schools, Minna, Government Day Secondary School, Tunga, Minna, and Zarumai Model School, Minna were purposely sampled for the study based on facilities, manpower, school type, and gender composition. These three schools were selected as the experimental groups, while Government Day Secondary School, Maikunkele, Minna was also sampled as the control group. 120 students were randomly selected using stratified random sampling technique. Each group was assigned into experimental group one, COOVIP (n = 30), experimental group two, COMVIP (n = 30), experimental group three, IVIP (n = 30) and control group, CVIP (n = 30). Equal numbers of male and female students were equally selected from each group.

### *Research Instrument*

The instruments for this research include: the treatment instrument "Video Instructional Package (VIP)" and the test instrument, "Geometry Achievement Test (GAT)".

**Video Instructional Package (VIP):** VIP was a self-instructional, user friendly and interactive package (contained buttons placed on the bottom of each page, such as *Play, Stop, Pause, Next and Previous* to provide easier control of the package) that lasted for 6 hours for an average student for six weeks. The package covered nine lessons (Angle at a point; Angles and Parallel lines; Angle properties of a triangle; Congruence and similarity of Triangles; Angles of a polygon; Parallelograms; Circles, Loci; and, Construction). All these are from the Geometry concept of the Nigerian senior secondary mathematics curriculum. It was developed by the researchers, with the assistance of video production experts. ADDIE (Analysis, Design, Development, Implementation, Evaluation) model of instructional system design was followed in the development of the video instructional package. At the design stage, needs analysis, learning outcomes, content analysis, storyboards, scripts, frameworks and other aspects of the video production were defined.

At the implementation stage, the video development was based on user-centered design, where the opinion, interests, needs, emotions, thoughts, and so on of users became key factors in the video's development.

**GAT:** The test instrument, Geometry Achievement Test (GAT), was a 50 item multiple choice objective test with five options (A – D) each which were drawn from the past West African Examination Council (WAEC) Senior Secondary Certificate Examination mathematics questions. The GAT was a standardized examination questions from WAEC which had been validated.

### **Validation and Reliability of Research Instruments**

**Video Instructional Package (VIP):** The face and content validation of VIP was done by three Mathematics lecturers and Educational Technology experts from Federal University of Technology, Minna. The experts examined the video appearance; operational techniques; spelling and grammatical errors; legibility and readability of the contents; clarity from the viewpoint of students unfamiliar with the content. All corrections and comments made by the experts were used for the final phase of the development of the VIP. In addition, end users' usability validation of the VIP was conducted on twenty secondary school students class two (SSSII) from Bosso Secondary School, Minna. The results obtained in the usability experience were used for improvement of the package.

**Geometry Achievement Test (GAT):** GAT is an adopted instrument from a recognized external examination body (WAEC) was not therefore subjected to any validation. GAT was administered as a pilot study on thirty selected senior secondary school students within the population and its reliability coefficient determined as 0.87 using Kuder Richardson 20 (KR 20). Hence, the instrument was considered to be reliable and consistent.

### **Method of Data Collection**

The objectives and the modalities of the experiments were specified and operational guide for each strategy was provided before the teachers and students were trained. All the groups (experimental and control groups) were subjected to the GAT as pre-test. Then, the students in the first experimental (cooperative) group were exposed to COOVIP, the second experimental (competitive) group were exposed to COMVIP, the third experimental (cooperative) group were exposed to IVIP which had been installed on desktop computers which contained the same content of GAT. Students in control group (conventional teaching method) were exposed to CVIP on the same content used for experimental group. The video instructional package was projected on to the screen. They were encouraged to take note and solve some mathematical problems. The treatment for all the groups lasted for six weeks. After the treatment the three groups were exposed to the GAT which had been rearranged as posttest.

#### *Experimental Procedure*

The following are the specific procedures for each group:

(i) *Experimental Group I: Cooperative Video Instructional Package (COOVIP):*

- (a) Students were assigned into three members heterogeneous group.
- (b) Each member was assigned with different responsibilities (e.g, group leader, time-keeper, scribe/quiet captain).
- (c) The groups were exposed to COOVIP where each group complete the reading of the materials, perform the tasks together and reached decision by consensus.
- (d) Each group turn in solutions. In order to ascertain that there was no free rider, students were given individual task (assignment) which was marked and recorded against group scores.
- (e) After the completion of a lesson, each task received a grade and each group members received the group grade (students sought help from each other towards the attainment of a common goal)
- (f) The scoring was done based on individual quiz score and team quiz score which were counted equally towards the student's final course grade.
- (g) High scoring teams is recognized and rewarded in the class on weekly basis.

(ii) *Experimental Group II: Competitive Video Instructional Package (COMVIP):*

- (a) Students were assigned into three members heterogeneous competitive group.
- (b) Group leader and time keeper were appointed
- (c) The groups were exposed to COMVIP where each competitive group complete the reading of the materials alone (the achievement of individual was independent of the group).
- (d) Each member within a group turn in different solutions and each received different grades based on individual performance
- (e) Each student worked to lead other members of the group
- (g) High scoring student within the group is recognized and rewarded in the class on weekly basis

(iii) *Individualized Video Instructional Package (IVIP):* In this method:

- (a) Each of the students was assigned to a computer
- (b) Each of the students worked independently
- (c) Each of the students did not allow seeking help from one another (they were widely separated from each other to prevent communication)
- (d) Each student turns in different solutions and received different grades based on individual performance
- (f) High scoring student is recognized and rewarded in the class on weekly basis

(iii) *Control Group: Conventional Video Instruction (CVIP):*

- (a) The entire class was exposed to CVIP using laptop connected LCD projector
- (b) The teacher introduced the lesson before the video presentation
- (b) Students were encouraged to listen and write down note
- (c) After the video presentation, the teacher opens a discussion on the lesson.
- (d) Comments, questions and discussions were entertained and more worked examples were provided.

Immediately after six weeks of treatment, GAT was administered as posttest to measure the achievement of different groups. The scripts were marked and marks allocated as zero for wrong answer and 2 marks for correct response making a total of 100 percent.

**Data Analysis Procedure**

The scores obtained were subjected to data analysis based on the stated hypotheses using One-way Analysis of Variance (ANOVA), Scheffe’s post-hoc analysis to determine area of differences, and t-test statistics were employed to analyze data. The significance of the various statistical analyses was ascertained at 0.05 alpha level.

**RESULTS**

The results are presented based on the research hypotheses. Data obtained after the administration of pretest was analysed using one-way ANOVA. The result is shown in Table1.

**Table 2: ANOVA pre-test on COOVIP, COMVIP, IVIP and CVIP groups**

Source of variables	Sums of square	df	Mean	F-calculated	p-value
Between Groups	11.858	3	1.475		
Within Groups	138.142	116	7.660	0.193 <sup>ns</sup>	0.901
Total	20150.000	119			

ns: Not Significant at 0.05 level

Table 1 shows the result of ANOVA comparison of the three experimental groups and control group at pre-test. From the table, the calculated F-value (0.193, p = 0.901) was not significant at 0.05 alpha level. This implies that there was no significant difference among the mean scores of the experimental group I (COOVIP), II (COMVIP, III (IVIP) and the control group (CVIP) at 0.05 level of significance. This results shows that students in the experimental groups and control group have the similar entry level with regards to previous knowledge of the topic treated. Thus, they are compatible groups.

**Hypothesis One:** There are no significant differences in the performance of students taught mathematics using COOVIP, COMVIP, IVIP.

To determine whether there were significant differences in the post-test mean scores of the COOVIP, COMVIP, IVIP and control group (CVIP), data were analyzed using the analysis of variance (ANOVA). Table 2 shows the result of the analysis.

**Table 3: ANOVA post-test on COOVIP, COMVIP, IVIP and CVIP groups**

Source of variables	Sums of square	df	Mean (x)	F-calculated	p-value
Between Groups	10119.733	3	3373.244		
Within Groups	1470.133	116	12.674	266.164*	0.000
Total	11589.867	119			

\* Significant at 0.05 level

Table 2 present the result of ANOVA comparison of the three experimental groups and control group at post-test. From the table, the calculated F-value (266.164,  $p = 0.000$ ) was significant at 0.05 alpha level. This indicates that statistically, significant difference was established among the experimental groups and control group. Hence the null hypothesis one ( $H_{01}$ ) was rejected.

Based on the established significant difference in the post-test achievement scores of the groups, Scheffe's test was used to determine the direction of the differences. The results of this post-hoc analysis are as shown in Table 3.

**Table 4: Scheffe's post-hoc analyses of the groups mean scores**

Groups	Mean Scores	Group I (COOVIP)	Group II (COMVIP)	Group III (IVIP)	Group IV (CVIP)
Group I (COOVIP)	86.00		*0.000	*0.000	*0.000
Group II (COMVIP)	74.67	*0.000		*0.017	*0.000
Group III (IVIP)	71.67	*0.000	*0.017		*0.000
Group IV (CVIP)	60.20	*0.000	*0.000	*0.000	

\* = Significant at the 0.05 level

The result in Table 3 indicates that there was significant difference in the posttest mean scores of students exposed to COOVIP ( $X = 86.00$ ) and those exposed to COMVIP ( $X = 74.67$ ). It also indicates significant difference in the posttest mean scores of students exposed to COMVIP ( $X = 74.67$ ) and those exposed to IVIP ( $71.67$ ). Significant difference was also established in the posttest mean scores of students exposed to IVIP ( $X = 71.67$ ) and those exposed to CVIP ( $X = 60.20$ ).

**Hypothesis Two:** There is no significant difference in the performance of male and female students taught mathematics using COOVIP.

To test this hypothesis, t-test statistic was also used to analyze the mean scores. The summary of this analysis is shown on table 4.

**Table 5: t-test analysis on performance scores of male and female students exposed to COOVIP**

Variable	N	df	Mean	SD	t-value	p-value
Male	15		86.13	3.962		
Female	15	28	85.87	2.973	0.209 <sup>ns</sup>	0.836

ns: Not Significant at 0.05 level

Table 4 presents the t-test of male and female students of experimental group I (COOVIP). The mean scores of male students were 86.13 and 85.87 for female students. The t-value of 0.209 was not significant at the 0.05 level. This indicates that there is statistically no significant difference between the male and female students taught with COOVIP, ( $t = 0.209$ ,  $df = 28$ ,  $p = 0.836$ ). Hence,  $H_{O2}$  was not rejected. Therefore, there is no significant difference between male and female students taught with COOVIP.

**Hypothesis Three:** There is no significant difference in the performance of male and female students taught mathematics using COMVIP.

To test this hypothesis, t-test statistic was also used to analyze the mean scores. The summary of this analysis is shown on table 5.

**Table 6: t-test analysis on achievement scores of male and female students exposed to COMVIP**

Variable	N	df	Mean	SD	t-value	p-value
Male	15		76.40	3.497		
Female	15	28	72.93	2.492	3.187*	0.004

\* = Significant at 0.05 level

Table 5 presents the t-test of male and female students of experimental group II (COMVIP). The mean scores of male students were 76.40 and 72.93 for the female students. The t-value of 3.187 was significant at the 0.05 level. This indicates that there was significant difference between the male and female students taught with COMVIP, ( $t = 3.187$ ,  $df = 28$ ,  $p = 0.004$ ). Hence,  $H_{O3}$  was rejected. Therefore, there is significant difference between male and female students taught with COMVIP in favour of male students.

**Hypothesis Four:** There is no significant difference in the performance of male and female students taught mathematics using IVIP.

To test this hypothesis, t-test statistic was also used to analyze the mean scores. The summary of this analysis is shown on table 6.

**Table 7: t-test analysis on achievement scores of male and female students exposed to IVIP**

Variable	N	df	Mean	SD	t-value	p-value
Male	15		71.20	3.278		
Female	15	28	72.13	3.502	0.754 <sup>ns</sup>	0.457

ns = not-significant at 0.05 level

The table 6 presents the t-test of male and female students of experimental group III (IVIP). The mean scores of the male students were (71.20) and male (72.13) for the female students. The t-value of 0.754 was

not significant at the 0.05 level. This indicates that there is statistically no significant difference between the male and female students taught with IVIP, ( $t = 0.754$ ,  $df = 28$ ,  $p = 0.457$ ). Hence,  $H_{O3}$  was not rejected. Therefore, there was no significant difference between male and female students taught with IVIP.

**Hypothesis Five:** There is no significant difference in the performance of male and female students taught mathematics using CVIP.

To test this hypothesis, t-test statistic was also used to analyze the mean scores. The summary of this analysis is shown on table 7.

**Table 8: t-test analysis on achievement scores of male and female students exposed to CVIP**

Variable	N	df	Mean	SD	t-value	p-value
Male	15		66.07	8.681		
Female	15	28	65.27	10.872	0.223 <sup>ns</sup>	0.825

ns = not-significant at 0.05 level

The table 7 presents the t-test of male and female students of control group (CVIP). The mean scores of the male students were (66.07) and male (65.37) for the female students. The t-value of 0.223 was not significant at the 0.05 level. This indicates that there is statistically no significant difference between the male and female students taught with CVIP, ( $t = 0.334$ ,  $df = 28$ ,  $p = 0.825$ ). Hence,  $H_{O3}$  was not rejected. Therefore, there was no significant difference between male and female students taught with CVIP.

## DISCUSSION

The results of the analysis of ANOVA on the performance of students taught Geometry using cooperative video instructional package (COOPVIP), competitive video instructional package (COMVIP), individualistic video instructional package (IVIP) and those taught using conventional video instructional package (CVIP) method of instruction indicate a significant difference in favour of the students taught with COOVIP. The findings agree with Gambari (2010), Johnson (2000), Johnson and Johnson (2005). Kumari and D'Souza (2011), Ning and Hornby (2010), Thangarajathi and Viola (2007), Topping, Thurston, Tolmie, Christie, Murray, and Karagiannidou (2011), Yusuf, Gambari and Olumorin (2012) who found that cooperative learning facilitates greater improvement on students performance in English, Mathematics and Science subjects than does competitive or individualistic learning environments.

The result also indicates that those taught with COOPVIP outperformed those taught using IVIP. The finding agrees with the findings of Fajola (2000), Gambari (2010), Yusuf and Afolabi (2010) which reported that students exposed to cooperative learning settings performed better than those exposed to the same programme individually. The result also indicates that those taught with COOPVIP outperformed those taught using CVIP. The finding supports the findings of Samuel and John (2004), Gupta and Pasrija (2012), Ajaja and Eravwoke (2010), Melihan and Sirri (2011), Yusuf, Olumorin and Gambari (2012) and Zakaria, Solfitri, Daud and Abidin (2013) which concluded that the cooperative learning method is more effective than the traditional teaching method in the academic success of students.

The superiority of COOPVIP over the COMVIP, IVIP and CVIP could be attributed to face-to-face interaction, positive interdependence, individual accountability, interpersonal and collaborative skills, and group processing which are the five elements essential for increasing the likelihood of success of the cooperative learning endeavour (Slavin, 2005). However, competitive instruction encourages an individual to be a winner, individualistic instruction allows an individual to work alone and move according to his own pace.

Gender has no influence on academic performance of student in cooperative setting. This finding agrees with the findings of Adeyemi (2008), Annetta, Mangrum, Holmes, Collazo and Cheng (2009), Gamvari (2010), Ifamuyiwa and Akinsola (2008), Kost, Pollock and Finkelstein (2009), Orabi (2007), Tharp-Taylor and Nelson-Le (2005) and Yusuf and Afolabi (2010) which reported no significant difference between male and female students taught using cooperative learning strategies.

Male students performed better than female students in competitive instructional strategy. This finding supports the earlier findings of Kolawole (2007) who reported that boys performed better than girls in competitive learning strategy in mathematics. Similarly, it also agrees with the findings of Aguele and Uhumniah (2008) and Croxford (2002) who found male students achieved significantly better than female students in science education.

Gender has no influence on academic performance of student in individualized instruction. This agrees with the findings of Gambari (2004), Gambari (2010) and Viann (2002) and Yusuf and Afolabi (2010) who reported no significant gender-related differences when students were exposed to individualized learning method.

## CONCLUSION

The paper has critically examined mathematics and its problems especially within the secondary school level in a rapidly changing world. Literatures on effectiveness of cooperative, competitive and individualized instructional strategies were reviewed. There is a wide gap to be filled on the use of technology such as video-based instructional package to support instructional strategies. The use of video-based instructional package in cooperative, competitive and individualized environments is an innovation. The use of video-based instruction in cooperative settings seems to be the answer. COOVIP was more effective in teaching the mathematical concepts of Geometry and are also gender friendly.

## RECOMMENDATIONS

Based on the findings of this study, the following recommendations are proffered: Teachers at secondary school level should expose mathematics students to video-based cooperative instructional strategy so as to improve their performance in mathematics. In addition, government and educational stakeholders should organize workshops on the use of video-based cooperative learning strategy to enhance better performance of secondary school students. Also, teacher education programme in Nigerian tertiary institutions should be improved upon to prepare teachers who can apply innovative approached (relevant technology), which will promote effective teaching and learning. Also, instructional designers, computer programmers, material developers should develop relevant instructional packages for use within the Nigerian school systems.

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