EFFECTIVENESS OF VIDEO-BASED COOPERATIVE LEARNING STRATEGY ON HIGH, MEDIUM AND LOW ACADEMIC ACHIEVERS

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Abstract

This study investigated the effect of cooperative, competitive and individualistic instructional strategies on the performance of high, medium and low academic achievers using video instructional package. A total of 120 senior secondary school mathematics students were randomly assigned into cooperative, competitive, individualized, and conventional teaching methods. Students from each group were stratified into high, medium and low achievers. Video Instructional Package (VIP) on mathematics and Geometry Achievement Test (GAT) were used as treatment and test instruments, respectively. Analysis of Variance and Scheffe test were used for data analysis. Findings indicated that there was significant difference in the performance of the groups in favour of cooperative learning strategy. Students' achievement levels had significant influence on their performance in competitive and individualized instructional settings. It was recommended that mathematics teachers should employ cooperative learning strategies to improve students' performance to bridge the gap among high, medium and low achievers.

Key Words: Video-Based Instruction, Cooperative Instructional Strategy, Competitive Instructional Strategy, Individualistic Instructional Strategy, Mathematics,

Introduction

Education is to assist individuals to maximize their potentials for optimal self and national development. Education is a prerequisite for meaningful and sustained national economy. Education cannot be of quality without effective teaching. The instructional method employed by teacher plays an important role in the acquisition of instructional contents for meaningful learning and development of necessary skills. Teacher-centered instructional methods make students passive with less interaction. Classrooms in Nigeria are predominantly dominated by such method of instruction which does not encourage students-students interaction. Lack of active participation of students is one of the factors responsible for students' poor performances in mathematics (O'connor, Kanja & Baba, 2000). Secondary schools students' performances are generally less than 50 percent in mathematics for the past one decade (West African Examination Council, WAEC, 2012).

Chukwu (2000) and Adegoke (2011) have criticized the lecture method use by teachers because only hardworking students can benefit from it. Ogunleye (2000) reported that in the era of technological advancement, technology has had minimum impact on education. This is because 80% of teachers in Nigeria are mostly using the chalkboard and textbook method (traditional method) in teaching. Video instructions have been tested in developed nations to determine its effectiveness in relation to learners' achievement. Video-based instruction can effective for teaching mathematics? To enhance the understanding of 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. Educators have recognized cooperative learning as a beneficial teaching-learning technique for different subjects (Zakaria, Solfitri, Daud & Abidin, 2013). Cooperative learning is a viable and effective instructional method for teaching and learning mathematics. It makes mathematics exciting and enjoyable for students and teachers. Classroom atmosphere in cooperative setting tends to be relaxed and informal, questions are freely asked and answered, and even shy students find it easy to be involved. Students become friends with their group members, and teachers-students' relationship become relaxed (Iqbal, 2004). 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.

Competitive instructional strategy is different from individualistic instruction because it

allows an individual to work according to his own pace. Through competitive instructional strategy, an individual wants to be a winner, succeeding without the group (Johnson & Johnson (1999). Majority of interactions are teacher–student which can create a competitive environment and produce a passive attitude toward learning as students vie for the teacher's approval (Killen, 2007; Harman & Nguyen, 2010).

Students in cooperative learning outperformed those in competitive and individualistic groups respectively (Johnson & Johnson, 1991, Nkebem, 2006). Nkebem (2006) further reported no significant difference between competitive and individualistic modes. Gupta and Pasrija (2012) explored the dominance of cooperative learning methods over conventional method of teaching in terms of achievement and retention. Cooperative learning promotes students' mathematics achievement than those taught with traditional method (Vaughan, 2002, Whicker, Bol, & Nunerery, 1997, Zakaria, Solfitri, Daud & Abidin, 2013). Studies have established that students exposed to computer-assisted cooperative learning settings performed better than those exposed to the same programme individually (Fajola, 2000, Gambari, 2010, Yusuf & Afolabi, 2010). In addition, cooperative learning method is more effective than the traditional teaching method in the academic success of students (Ajaja & Eravwoke, 2010, Samuel & John, 2004, Melihan & Sirri, 2011, Zakaria, Solfitri, Daud & Abidin, 2013).

Cooperative learning is a model of teaching for the purpose of eliminating the achievement gap while traditional methods focusing on individualism in schools may attribute to the achievement gap, cooperative learning focuses on interdependence and learning teams. Studies comparing the achievement of high, middle and low achieving students in competitive, individualistic and cooperative learning situations show that cooperative learning experiences tend to produce higher results for all ages, subject areas and for tasks involving concept attainment, verbal problem solving, categorization, retention and memory, motor performance, guessing, judging and predicting (Johnson & Johnson, 2000). Yusuf, M. (1997) found that there is no significant difference between the high and medium achievement level, and between students of medium and low achievement levels when taught social studies using videotape instruction. This was also supported by Yusuf A. (2004) who revealed that achievement levels have no influence on academic performance of the learners. However, studies other studies revealed that high ability students do perform better than low ability students (Aluko, 2004, Fajola 2000). Also, high achievers in cooperative learning outperformed medium and low achievers respectively (Aiyedun, 1995, Aluko, 2004, Gambari, 2012). Contrary to these, Sherman (1991) revealed that low achievers perform worse in cooperative learning.

Few researches have been carried out regarding the development of video-based instruction for teaching mathematics in cooperative, competitive and individualized environments at secondary school level of education in Nigeria. In addition, the extent of the interaction effects of students' achievement levels (high, medium, and low) on these strategies are yet to be fully confirmed in Nigeria. This study therefore examined cooperative, competitive and individualized use of video-based instruction on the academic performance of the high, medium and low achievers in mathematics.

Research Questions

The following research questions were raised to guide the study:

(i) What are the differences in the performance of students taught mathematics using cooperative (COOVIP), competitive (COMVIP) and individualistic (IVIP) video-based instructional strategies?

(ii) What are the interaction effects of students' achievement levels (high, medium and low) when they are taught using students taught mathematics using COOVIP, COMVIP, IVIP?

Research Hypotheses

The following null hypotheses were formulated and tested in the study.

(i) There is no significant difference in the performance of students taught mathematics using COOVIP, COMVIP, and IVIP video-based instructional strategies.

(ii) There is no significant difference in the performance of high, medium and low achiever students taught mathematics using COOVIP instructional strategy.

(iii) There is no significant difference in the performance of high, medium and low achiever students taught mathematics using COMVIP instructional strategy.

(iv) There is no significant difference in the performance of high, medium and low achiever students taught mathematics using IVIP instructional strategy.

RESEARCH METHODOLOGY

Research Design: A pretest, posttest, experimental control group design was employed in this study. Four levels of independent variable (cooperative, competitive, individualistic and control groups) and three levels of achievement levels (high, medium and low) were investigated on students' performance in Mathematics.

Sample: 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. In all, 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 high, medium and low students were equally selected from each group.

Research Instrument: The instruments for this research were the treatment instrument "Video Instructional Package (VIP)" and the test instrument, "Geometry Achievement Test (GAT)". The treatment instrument, Video Instructional Package (VIP) on Geometry, was a self-instructional, 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. It contained six lessons topics on 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. Validation and evaluation of the package was done by mathematics experts, educational technology specialists for the appearance, operation, spelling, grammar, readability, and clarity from the viewpoint of persons unfamiliar with the content. In addition, end users' usability validation was done through a pilot study on a sample, similar to the final sample used in the study. The test instrument, Geometry Achievement Test (GAT), a standard examination which had been validated, was a 50 item multiple choice objective test with five options (A – E) were drawn from the past West African Examination Council (WAEC) Senior Secondary Certificate Examination.

Experimental Procedure: The objectives and the modalities of the experiments were specified and operational guide for each strategy were provided for teachers and students. All the groups were subjected to the GAT as pre-test. Then, the students in the first experimental groups were exposed video-based instruction, while the control group was taught using conventional teaching method. The video instructional package was projected on the screen for the experimental groups. They were encouraged to take note and solve some mathematical problems. The treatment for all the groups lasted for six weeks. After the treatment all the groups were exposed to the re-arranged GAT as post-test. specific procedures for each group is fully discussed as follows:

(i) Experimental Group I: Cooperative Video Instructional Package (COOVIP): Students were assigned into three member heterogeneous group. Each member was assigned with different responsibilities such as group leader, time-keeper, scribe/quiet captain). These responsibilities are rotated weekly among the team members. The groups were exposed to COOVIP where each group complete the reading of the materials; perform the tasks together and reached decision by consensus. In order to ascertain that there was no free rider, students were given individual task (assignment) marked and recorded against group scores. After each lesson, each task received a grade and each group members received the group grade (students sought help from each other for attainment of a common goal). Scoring was done based on individual quiz score and team quiz score counted equally

towards the student's final course grade. High scoring teams is recognized and rewarded on weekly basis.

(ii) Experimental Group II: Competitive Video Instructional Package (COMVIP)*:* Students were assigned into three member heterogeneous competitive group. Group leader and time keeper were appointed within the group on weekly basis. The groups were exposed to COMVIP where each competitive group complete the reading of the materials alone (achievement of individual was independent of the group). Each member within a group turns in different solutions and each received different grades based on individual performance. Each student worked to lead other members of the group. After, the lesson, high scoring student within the group is recognized and rewarded in the class on weekly basis

(ii) Individualized Video Instructional Package (IVIP)*:* Each student was assigned to a computer and worked independently. Each of the student were prevented from seeking help from one another and they were widely separated from each other to prevent communication. Each student turns in different solutions and received different grades based on individual performance. After the lesson, high scoring student is recognized and rewarded in the class and this was done on weekly basis.

(iii) Control Group: Conventional Video Instruction (CVIP): The class was exposed to CVIP using laptop connected LCD projector. At the beginning, the teacher introduced the lesson before the video presentation. Students were encouraged to listen and write down note. In addition, after the video presentation, the teacher opens a discussion on the lesson. 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 scores obtained were subjected to data analysis based on the stated hypotheses using One-way Analysis of Variance and Scheffe's post-hoc analysis was employed to analyze data. The significance of the various statistical analyses was ascertained at 0.05 alpha level.

Results

To test for the hypotheses, the data were analysed using Analysis of Variance (ANOVA) and Scheffe's test using Statistical Package for Social Sciences (SPSS) version 16 at 0.05 alpha level. The results are presented based on the research hypotheses.

Table 1: ANOVA pre-test on COOVIP, COMVIP, IVIP and CVIP groups

Source of variables	Sums of square	df	Mean (x)	F-calculated	p-value
Between Groups	11.858	3	1.475		
Within Groups	138.142	116	7.660	0.193^{ns}	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. 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. This results shows that students in the experimental groups and control group have the same entry level with regards to previous knowledge of the topic treated.

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 CCI, ICI and control groups, data were analyzed using the analysis of variance (ANOVA). Table 2 contains the result of the analysis.

Table 2: 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. 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 (HO_1) 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 3: 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 (COMPVIP)	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	

* The mean difference is significant at the 0.05 level.

The result in Table 3 indicates that there was no 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 are no significant differences in the performance of high, medium and low achiever students taught mathematics using COOVIP.

To test this hypothesis, ANOVA statistic was used to analyze the mean scores. The summary of the analysis is shown on Table 4.

Table 4: ANOVA results on students achievement levels exposed to COOVIP.

Source of variables	**Sums of square**	**df**	**Mean (x̄)**	**F-calculated**	**p-value**
Between Groups	10.400	2	5.200		
Within Groups	333.600	27	12.356	0.421ns	0.661
Total	344.000	29			

ns: Not Significant at 0.05 level

Table 4 indicates the result of ANOVA comparison of students' achievement levels (high, medium and low). From the table, the calculated F-value (0.421, p = 0.661) was not significant at 0.05 alpha level. This implies that there was no significant difference among the mean scores of the high, medium and low groups, at 0.05 level. Therefore, hypothesis two was not rejected.

Hypothesis Three

There is no significant difference in the mean performance scores of high, medium and low students exposed to COMVIP.

To test this hypothesis, ANOVA statistic was used to analyze the mean scores. The summary of the analysis is shown on Table 5.

Table 5: ANOVA results on students achievement levels exposed to COMVIP.

Source of variables	Sums of square	df	Mean ($\bar{x}$)	F-calculated	p-value
Between Groups	259.467	2	129.733		
Within Groups	79.200	27	2.933	44.227^{ns}	0.000
Total	338.667	29			

ns: Not Significant at 0.05 level

Table 5 shows the result of ANOVA comparison of the three groups in experimental group II (COMVIP). From the table, the F-value (44.227, p = 0.000) was significant at 0.05 alpha level. This implies that there was significant difference among the mean scores of the high, medium and low achiever students in experimental group II (COMVIP) .

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 6.

Table 6: Scheffe's post-hoc analyses of the groups mean scores

Groups	Mean Scores	Group I (High)	Group II (Medium)	Group III (Low)
Group I (High)	78.20		*0.001	*0.000
Group II (Medium)	74.80	*0.001		*0.000
Group III (Low)	71.00	*0.000	*0.000	

* The mean difference is significant at the 0.05 level.

The results in Table 6 indicate that there was significant difference in the posttest mean scores of high achiever students (X = 78.20) and medium achievers (X = 74.80). It also indicates significant difference in the posttest mean scores of medium achievers (X = 74.80) and low achievers (71.00). Significant difference was also established in the posttest mean scores of high achiever (X = 78.20) and low achiever students (X = 71.00).

Hypothesis Three: There is no significant difference in the mean achievement scores of high, medium and low students exposed to IVIP.

To test this hypothesis, ANOVA statistic was used to analyze the mean scores. The summary of the analysis is shown on Table 7.

Table 7: ANOVA results on students achievement levels exposed to IVIP

Source of variables	Sums of squares	df	Mean Square	F-value	p-value
Between Groups	260.267	2	130.133		
Within Groups	68.400	27	2.533	51.368*	0.000
Total	328.667	29			

ns: Not Significant at 0.05 level

Table 7 shows the results of ANOVA comparison of high, medium and low achiever students exposed to IVIP. From the table, the F-value (51.368, p = 0.000) was significant at 0.05 alpha level. This implies that significant difference was established among the mean scores of the high, medium and low achiever students.

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

Table 8: Scheffe's post-hoc analyses of the groups mean scores

Groups	Mean Scores	Group I (High)	Group II (Medium)	Group III (Low)
Group I (High)	75.40		*0.000	*0.000
Group II (Medium)	71.40	*0.000		*0.001
Group III (Low)	68.20	*0.000	*0.001	

* The mean difference is significant at the 0.05 level.

The result in Table 8 indicates that there was significant difference in the posttest mean scores of high achiever exposed to IVIP (X = 75.40) and medium achiever (X = 71.40). It also indicates significant difference in the posttest mean scores of medium achiever students (X = 71.40) and low achiever (68.20). Significant difference was also established in the posttest mean scores of high achiever (X = 75.40) and low achiever students exposed to IVIP (X = 68.20).

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 Johnson and Johnson (1991) and Nkebem (2006). Students exposed to video-based cooperative instructional package performed better than those in conventional video-based instructional package, this agrees with the findings of Gupta and Pasrija (2012), Parven (2003) for general sciences and also positive gains in attitude and achievement of students exposed to mathematics in cooperative learning setting (Vaughan, 2002, Whicker et al., 1997, Zakaria, Solfitri, Daud & Abidin, 2013).

Results also indicated that those taught with COOPVIP outperformed those taught using IVIP. The finding agree with the findings of Fajola (2000), Gambari (2010), Yusuf and Afolabi (2010) which reported that students exposed to computer-assisted 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 support the findings of Samuel and John (2004), Ajaja and Eravwoke (2010), Melihan and Sirri (2011) which concluded that the cooperative learning method is more effective than the traditional teaching method in the academic success of students.

The success of COOPVIP over the COMVIP, IVIP and CVIP could be attributed to implementation of five elements of cooperative learning which include: face-to-face interaction, positive interdependence, individual accountability, interpersonal and collaborative skills, and group processing. On achievement levels (high, medium and low) ANOVA results showed that students' achievement levels have no influence on academic performance of student in cooperative setting, while achievement levels influenced their performance in competitive and individualized environments. This finding agrees with the findings of Yusuf, M. (1997) and Yusuf, A (2004) who found that there is no significant difference between the high and medium achievement level, and between students of medium and low achievement levels when taught social studies. However, this finding contradicts the findings of Aiyedun (1995), Yusuf (1997), Fajola (2000), Aluko (2004), and Gambari (2012) found that high achievers in cooperative learning outperformed medium and low achievers respectively. Goldman (2005) found that only the high and low achievers benefited from cooperative learning.

Conclusion

This study evaluated various literatures on effectiveness of cooperative, competitive and individualized instructional strategies. The study showed that the use of cooperative video-based instructional package improved the performance of students in mathematics (Geometry). The better

performance in Geometry could be as a result of the effectiveness of the COOPVIP package. Also, the COOPVIP enhanced the equal performance of students at different achievement levels (High, Medium and Low). In addition, competitive video-based instructional package (COMVIP) and individualized video-based instructional package (IVIP) favoured high achievers against medium and low achievers. COOVIP was more effective in teaching the mathematical concepts of Geometry and are also favour low and medium students.

Recommendations

Based on the findings of the study, the following recommendations were made. Video-based instruction should be used in cooperative settings to bridge the gap among high, medium and low achieving students. Also, instructional media such as computers should be provided and adequately programmed with variety of video-based instructional packages. Teachers at the secondary school level should be trained on implementation of cooperative learning strategies so as to improve their performance in mathematics.

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