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EFFECTS OF AUTHENTIC AND JIGSAW II LEARNING TECHNIQUES ON STUDENTS ACADEMIC ACHIEVEMENT IN MATHEMATICS

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ABSTRACT: *This study aimed to identify the effects of authentic learning technique (Experimental group 1, n = 42), Jigsaw II technique (experimental group 2, n = 42) and instructional teacher-cen-tered learning method (control group, n = 38) on students academic achievement in mathematics. The sample was drawn through simple random sampling technique. In this research, "pre-test/post-test with control group experimental design" was used. The data was collected through a forty item multiple choice objective test on mathematics which were tested for goodness of fit using the big step soft-ware. The internal consistency which was determined with cronback alpha was 0.72 while two research questions directed the conduct of the work. The data collected through the pretest and post test were analyzed by using the independent samples t-test with SPSS. The statistical analyses revealed that there were significant differences between the experimental and control groups in terms of academic achievement of students. It was recommended including others that students should be informed on the purposes of Jigsaw II and authentic learning qualities that the students should have.*

KEYWORDS: Jigsaw Technique, Authentic Technique, Instructional Teacher-Centered Technique, Cooperative Learning, Mathematics Academic Achievement.

INTRODUCTION

The National Policy on Education of Nigeria (2004) categorized mathematics in group A as one of the core subjects in both primary and secondary schools. Also, over the years, many students have phobia in mathematics as a subject despite the fact that it is one of the core subjects. In line with this development, Obinna (2009) reported that mathematics as a core subject in the secondary educational system has been a problem for many students depending on the prevailing environmental condition and at different points many have a high record of performance while in some occasions may as well record abysmal or poor performance. Against this background, Dike (2012) opined that there are so many factors that militate against student's performance in the subject. According to him, factors such as school environment, the teacher teaching techniques, peer group, etc, were all identified as impediments to students underachievement in mathematics. In view of this, the researcher decided to investigate the effects of Authentic and Jigsaw II learning techniques on students' academic achievement in mathematics.

Authentic learning method occurs continually in the context of a meaningful learning environment and reflects actual worthwhile learning experience that can be documented through observation, anecdotal records, journals, logs, work samples, portfolios, writing, discussions, experiments, presentations, projects and other methods (Emekene, 2013). Authentic learning may include individual as well as group task. The emphasis is on self

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reflection, understanding and growth rather than on learning of isolated facts (Bolling, 2004). The intent of authentic learning is to involve learners in task that require them to apply knowledge in real-world experiences. Authentic learning as apposed to more traditional forms of learning techniques involves learning tasks that simulates or are actually engaged with "real life" conditions or situations (Crafton, 2006). These are knowledge enhancing learning experiences. Students are required to acquire learning experiences that will require a complex employment of knowledge and skill in unpredictable real world contexts. The aim is to provide valid and accurate information about what students really know and are able to do in real contexts, under natural conditions (Iweka, 2015).

The modes of authentic learning according to Graham and Harris, 2005), are:

Problem-based learning (PBL): This is based on using real world problems and tasks in which a team of students over an extended period of time evaluate what they know and what they need to learn in order to gain the necessary capacities to generate an idea. It requires students to work with one another to identify and define problems and to formulate and test hypotheses, always searching for and applying theoretical knowledge and skills to new and ill-defined contexts.

Scenarios: It is a form of authentic learning whereby students are required to notice what is important, explain it by using theoretical concepts of the course, and plan and theoretically justify an intervention; or require students to notice critical factors in a given situation, investigate the implications and prepare a report for a prescribed audience for a prescribed purpose.

Portfolio: This requires that students understand and internalize the learning processes of a unit of study and then plan their own set of activities that will generate validated evidence of their performance capacity and skill mastery. The most important feature of the portfolio are the contents and commentary page in which the student directs the assessor to particular evidence in relation to specific outcomes to explain and justify their learning achievements.

Designing Authentic Learning: The designing of authentic learning technique requires considerable up-front work prior to the commencement of a unit. It requires (Johnson and Ward, 2001):

Clearly articulating the expected learning outcomes of the unit. Basically, any learning procedure can be authentic if it is grounded in well articulated learning outcomes reflecting real-world contexts. Based on these, the unit designer will then establish clear criteria and performance standards. Students require these learning outcome statements and performance criteria and standards to understand what is being asked of them and so to devise and undertake the learning activities to produce evidence of their achievements.

Designing the real world conditions. This requires describing problems, finding placements in authentic settings or designing a clear learning environment. Managing the learning load in authentic learning situations: Students may be over-jealous, producing very large portfolios or very long reports. It is important to set limits on the size of the submission if for no other reason than to manage students loads.

Jigsaw II learning technique is one of the cooperative leaning techniques that is based on group dynamics and social interactions. It is one of the "pure" cooperative learning techniques (Acikgoz, 2006:210). This technique, including two different treatments with different small

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groups in order to help learning and improving cooperation between students, was first designed by Aronson in 1978 (Hedeen,2003). In the application of Jigsaw II technique, students separate from their own groups and form new groups with the other students who are responsible for preparing the same subjects.

These groups, called "groups of experts" try to make other students understand the subject; they make plans about how they can teach the subject to their friends, and prepare a report. Afterward, they return to their own groups and teach the subjects to them with the help of the reports they have prepared. In the last stage, teachers can perform some activities with individuals, small groups or the whole class in order to unify students learning. For instance he/she can make one of the home groups or individual students make presentation in the classroom on their subjects. In the evaluation stage, the study is completed by making the evaluation proposed by the cooperative learning method (Simsek, 2007:19). Jigsaw II technique allows students to actively participate in learning process. By being constantly subjected to this method, they should feel more comfortable about their roles. Ways of evaluating the groups can enhance the effectiveness of the Jigsaw II technique by making each student have a sense of responsibility for their groups performances (Lucas, 2000:221).

In Jigsaw II technique, each student prepares a part of the assignment outside the classroom. Later, they turn to their groups and peer teach other members. Whereas all groups can take the same subject, different groups can take different parts of it as well. Groups are reorganized to teach the subject in turn (Grasha and Yabgarber, 2000). Jigsaw II technique supports cooperative learning by giving each student the responsibility to teach a part of the subject. In this technique, there are members of two different groups, "home group"and Jigsaw II group.

The Purpose of the Study

To determine the effects of jigsaw II technique, authentic learning technique and instructional teacher centered teaching methods on mathematics students in senior secondary schools in Ogba-Egbema Ndoni Local Government area of Rivers State in Nigeria.

Research Question

For this purpose, answers of the following research questions were sought:

1. To what extent does jigsaw II learning technique affect learning when compared to instructional teacher centered method of learning

2. To what extent does authentic learning technique affect learning when compared to instructional teacher centered method of learning

METHODOLOGY

Pre-test and post-test design with control group was used in this study. The effects of Jigsaw II technique, authentic learning technique and instructional teacher-centered teaching methods on mathematics students in senior secondary schools in Ogba, Egbema Ndoni Local Government Area of Rivers State in Nigeria were sought. The study made use of 122 (S.S.2) students. The sample was drawn through simple random sampling technique. A forty item multiple choice objective test on mathematics which were tested for goodness of fit using the Big step soft ware was used. The internal consistency which was determined by Cronbach Alpha was 0.72. The

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participants which are the 122 students consisted of three different classes of the S.S.2 students of the sample size. The researcher determined the number of the participants and the course which is appropriate for working in groups in the preparation stage of the research. There are some practices related to principles of Jigsaw II, authentic learning and instructional teacher-centered learning methods which are valid in both theory and practice. One of the classes was randomly assigned as experimental group 2 (n=42), another of the class was randomly assigned as experimental group 1 (n=42) and the third class was randomly assigned as the control group (n=38).

In the experimental group 1, the students learnt through Jigsaw II technique and experimental group 2 class learnt through authentic technique while the control class learnt through the instructional teacher-centered method. In order to explore the differences between the three groups in their academic achievement in the course, a test on mathematics was given to the three groups as pre-test at the beginning of the treatment and a post test at the end of the treatment. According to the data collected from the pre-test scores, it was found that there were no significant differences among the participants; thus experimental group 1, experimental group 2 and control group were selected based on a random selection technique.

After the grouping, the different groups were made to learn through their respective techniques, one hour a week for six weeks. At the end of the treatment, a post test was administered to the three groups. The data collected through the pretest and post test were analyzed with SPSS.

FINDINGS AND DISCUSSION

The findings of the study and interpretations on these findings are given. In the study, independent samples t-test, for the data obtained from the test on mathematics were used. Findings related to the differences between experimental group 1 (Jigsaw II technique group) and control groups academic achievements.

A t-test was used in order to explore whether there were differences between the experimental group1 (Jigsaw group) and the control group (instructional teacher-cenetered group) in terms of their performance in test scores of test on mathematics before and after the treatment.

Table 1: Findings related to levels of learning in the mathematics course by students in experimental Jigsaw II group and the control group.

	Groups	N	Mean	SD	t	P
	Control	38	14.76	2.10	0.342	0.733
Pre-test	Jigsaw	42	14.59	2.27		
	Control	38	21.79	1.74	4.376	0.000
Post-test	Jigsaw	42	23.33	1.41		

When table 1 is analyzed, it is seen that the t-score (o.342) related to the differences between pre-test scores of the jigsaw II experimental group and control group students was found to be non-significant (p>0.05).

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This reveals that there is no difference between experimental and control groups students pre-test scores. Also, in the analysis of the table 1, the t-score (4.376) related to the differences between the experimental and control group students' scores from the post-test was found to be significant (P<0.05).

This result shows that there is a difference between experimental and control group students in terms of their post-test scores. Again, in the table, it can be seen that the mean of post scores of the students in jigsaw II group is 23.33 and higher than the mean (21.79) at the scores of the control group students. As a result, it can be said that post scores of the students in jigsaw II group are higher than the scores of those in the control group. To find out if there are intra-group variance between pre-test and post test scores of the students in experimental and control groups a dependent samples t-test was used.

Table 2: Findings related to levels of learning in mathematics course by students in experimental Authentic Learning group and the control group (the traditional teacher-centered learning group).

Groups		N	Mean	SD	t	P
	Pre-test	42	14.59	2.24	23.49	80.00
Authentic group	post-test	42	23.33	1.41		
	Pre-test	38	14.76	2.10		
Control group					14.9	400.00
	post-test	38	21.79	1.74		

When table 2 is analyzed, it is seen that the t-score (23.498) related to pre and post-scores of the students in the Authentic learning group is significant at the level of 0.05 (P<0.05). These findings show that the difference between pre-and post-scores is significant. When the table is analyzed, it is seen that the mean of the post-test score is higher than the mean of the pre-test scores.

This finding indicates that the Authentic learning technique is more effective on students academic achievement in mathematics course classes. The t-score (14.940) pertaining to the variance between control group (instructional teacher-centered method) students scores from pre-and post-tests given to them before and after the treatment was found to be significant (P<0.05). When the table is analyzed, it is seen that the mean of the post-test scores is higher than the mean of the pre-test scores. This finding means that instructional teacher-centered method is also effective on the academic achievement level in mathematic course classes.

CONCLUSION

This study investigated the effects of jigsaw II and authentic learning methods on the academic achievement of students in mathematics course. In the study, the effects of jigsaw II and authentic learning techniques were investigated. It was found that after the treatment, there was a significant difference between the experimental group 1 in which jigsaw II was used and the control group in which instructional teacher-centered method was used. Also, there was a significant difference between the experimental group 2 in which authentic learning technique

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was used and the control group in which instructional teacher-centered method was used. After the analyses of data, it was found that jigsaw II technique was more effective than instructional teacher centered- teaching in the learning of mathematics. It was also found that the authentic learning method was more effective than instructional teacher centered learning technique in the learning of mathematics. This study and the study of Mattingly and Vansickle (1991) support Slavins (2007) claims related to the teaching conditions that should be provided for small groups for cooperative learning to be effective. The reason why the students in the jigsaw II group and the authentic learning group had higher scores than those in the control group can be attributed to the fact that students in the cooperative groups completely learn the subject topics by fulfilling their individual responsibilities, try to make their friends understand the topic, have affective interactions and are actually engaged with "real life situations and are all actively involved in the process. These, findings are in parallel with the other findings in literature (Ernest and Byra, 2008; Wilson, 2012; Huang, 2000; Johnson and Ward, 2001; Barrett, 2005; Ward and Lee, 2005;)

Findings of this study are in line with previous research revealing that cooperative learning has positive effects on students affective characteristics and attitude (Cai, 1997; Ernet and Byra; 1998; Dyson, 2001; Dyson, 2002).

However, they are not consist with the study of Mirzeoglu, 2000) and Gunes (2007) in which they could not find significant variances between the scores of experiences between the scores of experimental and control groups.

RECOMMENDATIONS

Taking into consideration, the high academic achievement levels of the students in the experimental groups, the following recommendations are made:

1. It is necessary to plan jigsaw II and authentic learning techniques and preparing the required tools and materials in advance.
2. Students should be informed on the purposes of jigsaw II and authentic learning qualities the students should have.
3. For authentic learning to effectively take place a meaningful learning environment must be put in place.

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