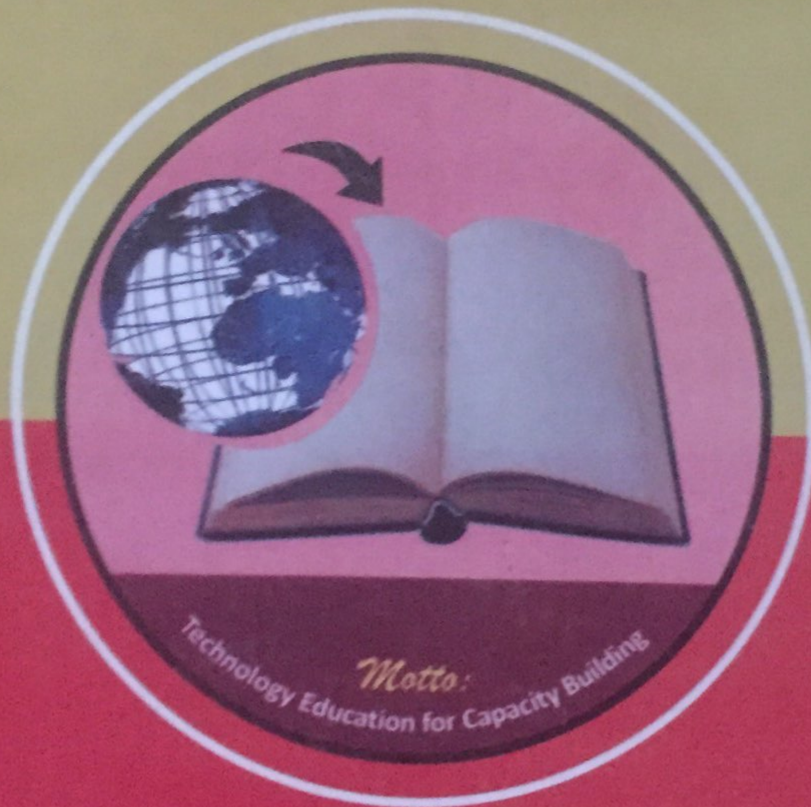


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## COMPARATIVE EFFECTS OF JIGSAW LEARNING TECHNIQUES AND CONVENTIONAL METHOD ON ACADEMIC ACHIEVEMENT AND RETENTION OF AHMADU BELLO UNIVERSITY STUDENTS IN BUSINESS MATHEMATICS IN NIGERIA

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### Abstract

This raising concern for persistent failure of students in business mathematics at Ahmadu Bello University, Zaria prompted the researchers to investigate the effectiveness of jigsaw technique on students' retention and academic achievement in the subject. Quasi-experimental design that implies the used two groups of students (Experimental and control) was employed in the study. All the 217 students that offered business mathematics in 2011/2012 academic session were used as the population and sample size. Two instruments titled Business Mathematics Retention Test (BMRT) and Business Mathematics Achievement Test (BMAT) were used for data collection. The first and second diagnostic tests were administered to the students after exposing the experimental group to treatment. The scripts of the testes were collected and marked using the drawn marking scheme. Marked scripts were coded into Statistical Package of Social Sciences (SPSS) 18. The package was used to run t-test in testing all the four null hypotheses at significance level of 0.05. The result of the study shows that students who learned business mathematics using jigsaw technique achieved better and have better retention ability than those in conventional lectures method. Based on the outcome of the study, the researchers recommended among others that, in skills related courses, lecturers should develop a paradigm that shift from teacher center to student center method of teaching.

**Key words:** Academic, Achievement, Business Mathematics, Conventional, Jigsaw technique, Students

### Introduction

The quest to improve students' academic achievement in schools and colleges, scholars suggested that student-centered teaching model, method and technique should be used. One of the model suggested is jigsaw learning method otherwise known as jigsaw technique. The technique is an active strategy with small groups that develops the learning of both individual and the group members. Doymuş, Karaçöp and Şimşek (2010), Tan, Wen, Jiang, Du and Hu, (2012) and Ufuk, Bayram and Birgül (2014) define jigsaw technique as a learning approach that students learn from each other creating a small mixed groups towards a common purpose in an academic subject in both classroom and other environments, increased self-confidence and communication skills of individuals, strengthened the power of problem-solving and critical thinking as students participates actively in the process of education. In the technique, learners are expected to indicate an effort that supports the learning of both self and colleagues as it contains a certain amount of togetherness of idea and goal.

The technique was based on the theory of social interdependence, which focuses on the roles of various types of co-operative, competitive and individualistic goal structures (Johnson & Johnson, 1999; Johnson, Johnson, & Smith, 1998; Slavin, 1996). The theory assumed that social inter-dependence created by goal specification as influence on the behavior of individuals act and the outcome of members of the group. According Johnson and Johnson (1999), jigsaw technique involves:- face-to-face interaction and active participation with one another; individual accountability and share of learning experiences which helps in goal achievement; interpersonal and small-group skills that are necessary for quality learning; sufficient time for group work and monitoring of goal achievement; and positive inter-dependence which involves students cooperating, supporting, and helping one another to be successful.

Jigsaw been interactive learning method require students to work in groups, shared learning objectives,



exchange information, principle and in assuring permanence in learning. The technique is considered to support for promoting productive changes in teaching methods that improve student learning, and their attitudes toward learning. According to Slavin (1996), and Polloway, Patton and Serna (2001) the technique is one of the most successfully explored instructional strategies in the history of educational research. They posit that the technique increases the students' class participation, academic achievement and motivation toward learning. Considering the assertions of these scholars on the technique incited the researcher to investigate whether it will be the appropriate method that will help to improve the academic achievement and retention ability of University students in Business mathematics.

### Statement of the Problem

Business mathematics is one of the core subjects in the curriculum of business education in Ahmadu Bello University, Zaria. In the institution, not minding whether a student is in accounting, distributive or secretarial option, he/she must offer and pass business mathematics before graduation. To achieve this, a credit pass at ordinary level is made as one of the requirements for admission into the programme. Despite this, students in this programme have considered the subject as one of the difficult courses in the programme. The difficulty of the course by most of the students can be understood by their general complain and the persistent poor performance. The poor performance in the subject is not from business education students alone, even students who offered the course as elective from other departments have found themselves completely at a loss at lectures and during examinations. For instance in 2012, one hundred and eleven (111) students who sat for the examination, 22 had weak passes while 12 had failed. Similarly, in 2013, one hundred and thirty (130) students sat for the examination, fifteen (15) of them had weak grades while 19 failed. The situations which remain almost the same yearly have led many undergraduates to carry the course over. The circumstance is more worrisome and frustrating as it resulted to *spill over which* elongates students' graduation. The possible reason for this might be that the technique used in the teaching/learning is no adequate enough to provide students with understanding of the course. In a quest to improve students' performance, scholars such as Snyder (2000), Van & Ramon (2012) and Tran (2014) reported the effectiveness of jigsaw technique. The reports prompted the researchers to find out the effects of jigsaw technique on achievement and retention ability of Ahmadu Bello University students in Business mathematics.

### Purpose of the Study

The present research aims at investigating the influence of using jigsaw technique in the academic achievement and retention of undergraduate students in business mathematics. Specifically, the study:-

1. determine the mean difference in the academic achievement of undergraduate students that learned business mathematics using jigsaw techniques and those that learned using conventional lecture method;
2. determine the mean difference in the academic achievement of male and that of female students that learned business mathematics using jigsaw technique;
3. determine the mean difference in the retention ability of undergraduate students that learned business mathematics using jigsaw techniques and those that learned using conventional lecture method; and
4. determine the mean difference in the retention ability of male and that of female students that learned business mathematics using jigsaw technique.

### Hypotheses of the Study

The following null hypotheses were tested using t-test at significance level of 0.05.

- $H_{01}$  There is no statistical significant differences in the academic achievement of undergraduate students that learned business mathematics using jigsaw techniques and those that learned using conventional lecture method;
- $H_{02}$  There is no statistical significant difference in the mean performance of male and that of female students that learned business mathematics using jigsaw technique;
- $H_{03}$  There is no statistical significant differences in retention ability of undergraduate students that learned business mathematics using jigsaw techniques and those that learned using conventional lecture method; and
- $H_{04}$  There is no statistical significant difference in the retention ability achievement of male and that of female students that learned business mathematics using jigsaw technique.



## Methodology

### Research Design

To test the effectiveness jigsaw technique on the academic achievement of students in business mathematics (VTEB 205), two groups post-test experimental design was used. The first group used jigsaw technique while the second group was subjected to conventional lecture method.

### Population and Sample for the Study

The population for this study comprising of all students that offered business mathematics (VTEB 205) in 2011/2012 academic session in Ahmadu Bello University, Zaria. The population was 217 students comprising of 111 in regular and 106 in Long Vocational Training (LVT) programme. The population was manageable; hence the entire 217 students were used for the study. The students were divided into two groups based on their mode of entry (regular and LVT). In the experimental group, regular students were used, while LVT students constituted the controlled group. This helped to prevent the effect of any extraneous variables that may arise due to contact of students. To further control the intervening variables of time the exercise took place between 8am to 10am in the morning.

### Instrument for data Collections

Two instruments were used for data collection from the students. The first instrument was 20 filling the gaps questions titled Business Mathematics Retention Test (BMRT). This instrument was used to determine students' retention ability. The second instrument was five essay questions titled Business Mathematics Achievement Test (BMAT). The instrument was used to determine the academic achievement of students in business mathematics. The validity of the instruments (BMRT and BMAT) was established by board of examiners in department of vocational and technical education in Ahmadu Bello University, Zaria. Pilot study was used to establish the reliability of the instruments, the instruments were distributed to students who were not involved in the study but had taken the course in 2010/2011 academic session. The data collected from pilot study was subjected into Cronbach's alpha for the internal consistency reliability, the result revealed reliability coefficient of 0.69.

### Procedures for Data Collection

In the first stage of data collection, the researchers taught course in line with the university approved course contents. Towards the end of the first semester or contact, first diagnostic test (BMRT) was administered to students which lasted for 40 minutes. The second diagnostic test (BMAT) was administered at the end of the semester or contact which lasted for 2.15 hours. In each case, the instruments were administered, invigilated and retrieved by the researchers and research assistant. The scripts of the first and second diagnostic test were marked using the drawn marking scheme.

### Technique for Data Analyses

In the analyses, the researcher coded the data collected into Statistical Package of Social Sciences (SPSS) 18. The t-test was employed to test all the four null hypotheses at significance level of 0.05.

### Result of the Study

Results of the study is presented in Table 1 to Table 4

$H_{01}$  There is no statistically significant differences in the academic achievement of undergraduate students that learned business mathematics using jigsaw techniques and those that learned using conventional lecture method

Result of test of null hypothesis four is presented in Table 1

Table 1  
Test of difference in the academic achievement of undergraduate students in business mathematics using jigsaw and conventional lecture method.

Group of Students	N	df	Mean	Std. Dev.	t-cal	t- crit	Sig. (2- tailed)
Students learned using jigsaw techniques	111	205	58.20	2.52	2.22*	1.96	0.002
Students learned using conventional method	106		46.30	2.01			

Significant  $P < 0.05$



Table 1 revealed the mean achievement scores for business education students that learned business mathematics using jigsaw technique and those that learned using conventional teaching method is 58.20 and 46.30 respectively. The calculated value was greater than the table value ( $2.22 > 1.96$ ). The probability of 0.002 was  $< 0.05$  level of significance. The analysis therefore shows that the mean achievement scores for students learned business mathematics using jigsaw technique significantly differed from that of their counterparts learned using conventional lectures method, hence null hypothesis one is therefore not retained.

**HO<sub>2</sub>** There is no statistically significant difference in the mean performance of male and that of female students that learned business mathematics using jigsaw technique

Result of test of null hypothesis two is presented in Table 2

**Table 2**

**Test of Difference in the Academic Achievement of Male and Female Students in Business Mathematics using Jigsaw Technique.**

Group	Gender	N	df	Mean	Std. Dev	t-cal	t-crti	Sig. (2-tailed)
Experiment	Male	56	109	63.02	2.91	1.82*	1.96	0.052
	Female	55		59.38	2.13			

The result of t-test analysis used to test null hypothesis two in Table 2 revealed the mean performance of 63.02 with standard deviation of 2.91 for male students against 59.38 and 2.13 for female students. The calculated value was less than the critical value ( $1.82 < 1.96$ ). The probability value also shows that  $P > 0.05$ , the analysis shows that there is no difference in the mean performance of male and that of female students that learned business mathematics using jigsaw technique. Based on the analysis, the null hypothesis two was retained.

**Ho<sub>3</sub>** there is no statistically significant differences in retention ability of undergraduate students that learned business mathematics using jigsaw techniques and those that learned using conventional lecture method

**Table 3:**

**Test of Difference in the Retention Ability of Students in Business Mathematics using Jigsaw and Conventional Lecture Method.**

Group of Students	N	df	Mean	Std. Dev	t-cal	t-crti	Sig. (2-tailed)
Students learned using jigsaw techniques	111	205	62.84	2.01	2.10*	1.96	0.000
Students learned using conventional lecture method	106		50.09	1.88			

The t-test analysis used to test null hypothesis three in Table 3 revealed the mean retention of score of 62.84 for students that were learned using jigsaw technique with standard deviation of 2.01. Those that were learned using conventional lectures method had mean score of 50.09 with standard deviation of 1.88. The calculated value of 2.10 was greater than the table value 1.96. The probability was less than the alpha value ( $0.000 < 0.05$ ), the analysis shows that the retention ability of students learned using jigsaw technique significantly differed from that of their counterparts learned using conventional lectures method, hence null hypothesis three was not retained.

**HO<sub>1</sub>** There is no statistically significant difference in the retention ability achievement of male and that of female students that learned business mathematics using jigsaw technique

Analysis of t-test used to test null hypothesis one is as presented in Table 1



Table 4

Test of Difference in The Retention Ability of Male and female Students in Business Mathematics using Jigsaw Technique.

Group	Gender	N	Df	Mean	Std. Dev	t-cal	t-crti	Sig. (2-tailed)
Experimental	Male	56	109	64.80	2.02	1.10*	1.96	0.061
	Female	55		60.07	1.99			

The analysis of t-test used to test null hypothesis one in Table 1 indicates the mean retention of ability of male students 64.80 against 60.07 for females with standard deviation of 2.02 and 1.99 respectively. The calculated value was 1.10 against critical value of 1.96. The probability value was greater than the alpha ( $0.061 > 0.05$ ). The analysis shows that there is no difference in the retention ability of male and that of female students that learned business mathematics using jigsaw technique, hence null hypothesis two was retained.

### Discussion of the Findings

The outcome of test of null hypothesis one shows that the academic achievement of undergraduate students that learned business mathematics using jigsaw techniques significantly performed better than those that learned using conventional lecture method. This further affirmed the assertion of Johnson, Johnson and Holubec (1986) who reported that cooperative learning activities enhance elaborative thinking and more frequent giving and receiving of explanations, which has the potential to increase depth of understanding, the quality of reasoning, and the accuracy of long term retention. Similarly, Slavin (1990) reports that the struggle to resolve potential conflicts during jigsaw technique results in the development of higher levels of understanding and retention ability of students. The assertion of Whicker & Nunnery (1997) also indicates that development of group cohesion enhances their productivity that impedes the group dynamic and ultimately academic achievement. This result also conforms to the findings of Hanze & Berger (2007) and Fengfeng and Barbara (2007) maintained that Jigsaw cooperative teaching strategy improved achievement scores compared to the conventional teaching methods. Similar, the assertion of Bilesanmi-Awoderu and Oludipe (2012) shows that Jigsaw cooperative learning strategy results in higher learners' achievement because they engage in challenging tasks in their expert groups with enthusiasm because they know they have to convey the information when they move back to their respective home groups. The outcome of the study may be attributed to friendly relationships among learners, and getting help as the share information, teach one another and enjoying the jigsaw context.

The test of null hypothesis two revealed that there is no difference in the academic achievement of male and that of female students that learned business mathematics using jigsaw technique. The outcome of the results implies that if the method used in teaching students is effective, irrespective of the gender, they will benefit equally. The finding is similar with earlier research of Golbeck & Sinagra (2000) which shows that no gender differences were found in the co-operative and competitive learning condition of students. Similarly, Etukudo (2003), Spencer (2004), Osemwinyen (2009) and Iwendi, (2012) also reported that if method for teaching is effective, there will not be statistical difference between male and that of female students in mathematics. In same lane, Johnson & Johnson (2005) reported that cooperative learning results in more positive attitudes toward learning regardless of gender. The study of Ajaja & Eravwoke (2010) also shows that a non-significant difference in achievement test scores between the male and that of female students learned using cooperative technique. Findings of the study conducted by Shihab (2011) also indicated that there was no statistically significant difference in the students' achievement due to gender.

The test of null hypothesis three revealed that students that learned using jigsaw technique has better retention ability than those that learned using conventional lectures method. The study supported the finding of Similar Johnson & Johnson (2006) maintained that jigsaw technique helped students obtain more knowledge and promoted greater long-term retention. The academic achievement and retention of students in the cooperative learning context are strongly correlated as reported by Johnson & Johnson's (2009). Concurring this, Van and Ramon (2012) reported that, students that are learned using jigsaw technique gained more knowledge. Tran & Lewis (2012) noted that performance and retention of students that are learned using jigsaw technique was better than those in the control group. In a related study



reported by Gillies (2006), Hennessy & Evans (2006), Johnson, Johnson & Stanne (2000), Bukunola & Idowu (2012) and Şimşek (2012) posits that the (retention ability and academic) achievement effects of cooperative learning is more than the conventional lecture method Bilesanmi-Awoderu and Oludipe (2012) also reported that the active involvement of students in jigsaw teaching strategies brought about high level of students retention.

The results of hypotheses four shows that there is no significant different on the retention ability of male and that of female students that learned business mathematics using jigsaw technique. The finding of the study is similar with that of Birgan (2010) who reported that, there will be no difference in the retention rates among students regardless of their gender if an appropriate teaching technique is applied. The study of Ajaja & Eravwoke (2010) also reported a non-significant difference in retention and achievement test scores between the male and that of female students in the cooperative learning group. This also confirmed that of Lori (2013) who established that group composition in terms of sex does not have a significant influence on the outcomes of cooperative efforts. Lori stressed that the technique promote higher achievement and the retention of students regardless of their gender difference.

### Conclusion

The result of the study revealed evidence that supports the positive impact of jigsaw technique on the retention ability and academic achievement of students in business mathematics. The reason behind these could be attributed to the fact that students' attitudes in cooperative learning group are more positive than those they held in conventional lectures method. Considering that jigsaw technique creates room for interdependent relationships among students, participation, exchange of information and collaboration in academic work, students that learned using this method have a better chance of understanding the course than those that learned using conventional lectures method, hence the technique holds great promise for business mathematics students regardless of gender differences.

### Recommendations

Based on the outcome of the study, the researchers recommended that:-

1. in skills related courses, lecturers should develop a paradigm that shift from conventional lectures method which is teacher centered to jigsaw technique which is more of student centered.
2. for Jigsaw to be effective learners must be ready to interact, share ideas and information among themselves, hence all the students must go on research, read harder and encourage to participate in teaching and learning exercise.
3. teachers should endeavour to attend seminars and workshops. These will enable them to acquire skills and competency required for effective adoption of jigsaw teaching technique.
4. Teachers that are teaching courses that required retention, jigsaw method should be adopted as this will help to improve students' retention ability.

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