A COMPARISON ON THE EFFECT OF TEACHING MATHEMATICS USING DISCOVERY AND TRADITIONAL METHODS IN SOLVING MATHEMATICAL PROBLEMS IN SENIOR SECONDARY SCHOOLS OF BIRNIN KEBBI LOCAL GOVERNMENT

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Abstract

This study was carried out to examine the effectiveness of discovery and traditional approaches on the learning of some mathematical concepts. The study tries to show the difference in achievements of two groups of SS2 students in Birnin Kebbi Local Government who were exposed to discovery and traditional pedagogy respectively in Army Day Secondary School. Four research hypotheses were formulated to guide the study. A pre-test post-test quasi experimental design was adopted. The population consisted of five thousand two hundred and seven (5,207) students out of which 357 students were sampled. Using mean, standard deviation and t-test statistics, it was discovered that students taught using discovery strategy perform better academically. The experimental data revealed two important results. Firstly, adopting discovery learning approach significantly improves students' achievement in mathematics as compared to using traditional teaching method. Secondly, most of the students who improved their abilities of understanding and reflection indicated that discovery learning approach can help them to understand, integrate and clarify mathematical concept and also enhance their interest to participate in problem solving. Different stake holders like teachers, parents and teacher educators in favour of the discovery pedagogy suggested that the present classroom practice need to be changed. Based upon the above findings, it is recommended that discovery approach is more effective strategy to learning mathematics, which teachers need to employ in their teaching.

***Key words**: comparison, mathematics, discovery method and traditional method.*

Introduction

Discovery learning is one strategy that can enable all the learners to discover valid knowledge and also enable them to transmit it in different contexts. Learning in the discovery framework contributes to intellectual, social and psychological development of learners unlike other methods of instruction. Discovery pedagogy in mathematics believes that learner can discover knowledge by active participation rather than acquiring knowledge by watching teachers' demonstration in the classroom and, to learn to speak and act mathematically participating in mathematical discussion and solving new or unfamiliar problems (Richards, 1991).

Traditional instruction attempts to present information to learners in a form they can easily access and understand. Traditional method include demonstrating, lecturing, explaining, narrating, requiring students to read a textbook or manual, showing students an instructional video, or asking students to work through a computer program presenting information. In traditional approach, it is assumed that learners will process new information thoughtfully, and that it will link in an organized manner with their prior knowledge. Ormrod (2000) remarks, 'Perhaps the major advantage of traditional instruction is that it enables students to explore a topic in an organized and relatively time-efficient manner'.

Statement of the Problem

Several decades of pedagogical research have now clearly shown that what teachers do in the classroom is undoubtedly the key educational determinant in student learning and achievement. It goes without saying that not all teaching practices are equal in this respect. It is therefore important to identify and promote the most effective practices, that is to say, practices which help pupils to achieve desired learning outcomes in the most effective way. From this perspective, there is a general rejection (on the part of researchers, decision-makers, teacher trainers, educational support staff, parents, classroom practitioners) of what is referred to as "traditional" teaching. This is a form of teaching, dominated by the teacher, which relegates pupils to a passive role, reduces their classroom activity to the memorization of data to be recited to the teacher, and in particular, leads to the acquisition of skills of a lower taxonomic level. Students often had difficulty learning in mathematics classrooms because they had to overcome previous misconceptions and needed to see information presented to them in new and

Research Questions

In line with the statement of the problem, the following research questions were raised in this study:

1. Is there any significant difference in achievement between students taught using discovery method and those taught using traditional method?

2.	Is there any significant difference between the achievement of males and females taught using discovery method?

3.	Is there any significant difference between the achievement of males and females taught using traditional method?

4.	Do mathematics teachers prefer to teach using discovery method or Traditional method?

Research Hypotheses

From the research questions, the following null hypotheses were formulated and will be tested at 5% level of significance.

Ho_1:	There is no significant difference between students taught using discovery method and those taught using traditional method.

Ho_2:	There is no significant difference between the achievement of males and females taught using discovery method.

Ho_3:	There is no significant difference between the achievement of males and females taught using traditional method.

Ho_4:	There is no significant difference in preference between mathematics teachers who use discovery and those who use traditional methods.

Objectives of the Study

The study intends to achieve the following objectives:

1.   The effect of different teaching methods.

2.   The effect of different assessment methods.

3.   Students self-efficacy levels using different teaching methods.

4.   Whether discovery method is more effective than traditional strategy of
       teaching on the achievement of students in mathematics.

METHODOLOGY

Population and Sample

A pre-test post-test using quasi experimental design was adopted. All the senior secondary school students in Birnin Kebbi local government constituted the population of the study. There were twenty three (23) senior secondary schools with a total of five thousand two hundred and seven (5,207) students out of which three thousand one hundred and fifty nine (3,159) were males and two thousand and forty eight (2048) were females. The researchers adopted a purposive sampling technique in selecting the school and the level of the students from which the sample was drawn. The respondents were randomly drawn from a group of senior secondary school two (SS2) students in Army day secondary school.   A total of three hundred and fifty (350) participants were taken as sample as suggested by Krejcie and Morgan (1970).

Instrumentation

Two sets of tests were designed by the researchers for the study; the first is a self-developed pre-test and posttest titled Mathematics Achievement Test (MAT) for the students. The pretest and post-test were parallel with items of same difficulty level and pattern, composing 25 multiple-choice test items. The second test is the Mathematics Teachers' Questionnaire (MTQ) for the teachers, which consists of twenty five (25) questions based on teachers' preference in relation to discovery method and traditional method. The questions are in the form of a four-point likert scale of strongly agree (SA), agree (A), disagree (D) and strongly disagree (SD).

Validity and Reliability of the Research Instruments

The Mathematics Achievement Test (MAT) and Mathematics Teachers' Questionnaire (MTQ) were all validated by the specialists in the department of education, Waziri Umaru Federal Polytechnic Birnin Kebbi, Kebbi State. A trial testing of the instrument was carried out on a sample of 15 students which were not part of the targeted sample. By means of split-half method, a Spearman-brown equal-length value reliability coefficient of 0.83 was achieved. Also a reliability coefficient of 0.70 was found for the teachers' questionnaire using Cronbach alpha method. Thus, by the obtained coefficients, the instruments were found reliable for the study.

Procedure for Data Collection and Data Analysis

The pre-test and post-test were administered at allocated time to the respondents; both groups completed the test at the given time ($1\frac{1}{2}$ hour). The answer scripts were immediately collected and were marked fairly and honestly by the researchers. The response of the respondents on pre-test and post-test were scored according to the key. When the respondent gives correct response to an item, he/she will be given two score (i.e. 2 marks) for that item while zero score will be earned by a blank or an incorrect response. The list of the scores of students was prepared by the researcher. In scoring the response of the teachers' questionnaire (i. e. MTQ), respondents have a possible score ranging from 4-1 which represents his/her opinion on each item. The higher the score, the more influenced the respondent is by the item. The highest possible score is 100 (i.e. 4×25) while the lowest score is 25 (1×25) and the range of the scores is 75 (i.e. 100-25). The mid-point of the range is 37.5. The cut-off point is 62.5 (i.e. maximum score minus mid-point of the range 100-37.5 or the minimum score plus the mid-point of the range 25+37.5). Thus, respondents who obtained scores from 62.5 to 100 were considered as teachers who prefer to use discovery method while those respondents who obtained scores below 62.5 were considered as teachers who prefer to use traditional method. Scores obtained from the study was presented in tabulator form using SPSS 17.0 version (2009) software for data storage and for data calculation. The collected data was

analyzed using mean, standard deviation, t-test and simple frequency percentages all at 0.05 level of significance.

DATA PRESENTATION AND ANALYSIS

Ho_1: There is no significant difference between students taught using discovery method and those taught using traditional method.

Table 1: Significance of Difference between Scores of Experimental Group and Control Group

	Group	N	Mean	Std. Deviation	Std. Err Mean	t-cal.	t-val.
				Group Statistics			
Scores	Experimental group	50	53.48	6.529	0.923	7.534	1.968
	Control group	50	43.70	6.453	0.913		

A two sample independent t-test was computed and found to be equal to 7.534. From the above table (table I), the mean achievement scores of the experimental and control group were 53.48 and 43.70 respectively. T-test was used to determine whether there is significant difference between the mean scores of experimental and control group. The table showed that t-calculated is 7.534 while t-value is 1.984 at 5% level of significant. Since t-cal. is greater than the t-val., the null hypotheses is rejected, which means there is significant difference between the experimental and control group.

Ho$_2$: There is no significant difference between the achievement of males and females taught using discovery method.

Table 2: Significance of Difference between males and females with regards to discovery method

	Group Statistics						
	Group	N	Mean	Std. Deviation	Std. Err Mean	t-cal.	t-val.
Scores	Males	30	52.57	6.474	1.182	-1.218	1.984
	Females	20	54.85	6.532	1.460		

A two sample independent t-test was computed and found to be equal to -1.218. From the above table (table II), the mean achievement scores of males and females were 52.57 and 54.85 respectively. T-test was used to determine whether there is significant difference between the mean scores of males and females with regards to discovery method. The table showed that t-calculated is -1.218 while t-value is 1.984at 5% level of significant. Since t-cal. is less than the t-val., the null hypotheses is retained, which means there is no significant difference between the achievement of males and females with regards to discovery method.

Ho$_3$: There is no significant difference between the achievement of males and females taught using traditional method.

Table 3: Significance of difference between males and females with regards to discovery method

	Group Statistics						
	Group	N	Mean	Std. Deviation	Std. Err Mean	t-cal.	t-val.
Scores	Experimental group	30	41.33	5.726	1.045	-2.528	1.984
	Control group	20	47.25	5.937	1.328		

A two sample independent t-test was computed and found to be equal to -1.528. From the above table (table III), the mean achievement scores of males and females were 41.33 and 47.25 respectively. T-test was used to determine whether there is significant difference between the mean scores of males and females with regards to traditional method. The table showed that t-calculated is -2.528 while t-value is 1.984at 5% level of significant. Since t-cal. is greater than the t-val., the null hypothesis is rejected, which means there is significant difference between the achievement of males and females with regards to traditional method.

Ho$_4$: There is no significant difference in preference between mathematics teachers who use discovery and those who use traditional methods.

Table IV: Summary of the responses from teachers in percentage on teacher preference with regards to teaching approaches (discovery or traditional approach).

Teaching approach	Teacher preference	Percentage (%)
Discovery	6	30
Traditional	14	70
Total	20	100

Table 4 indicates that 6 teachers representing 30% of the total preferences choose discovery teaching approach while 14 of the teachers representing 70% of the total preferences choose traditional teaching approach. From the result shown above, teachers in Birnin Kebbi prefer to use traditional method than discovery method in teaching mathematics.

Discussions of Results

Result from table 1 revealed that there is a significant difference between the pre-test mean achievement scores of the experimental and controlled group, this is because the t-value calculated (7.534) is greater than t-value critical (1.984) at 5% level of significant. These result support the study of Lerch and Hamilton (1970), Luzmanuel (1990), Nuzum (1991), Battista (1999) and Chang, Kaur, Koay and Lee (2001). The result in table II shows a significant difference between post-test mean achievements scores of males and females with regards to discovery approach, the significant difference is in favour of the males' students with the mean score of 52.57. The table showed that t-calculated is -2.218 while t-value is 1.984at 5% level of significant. Since t-cal. is less than the t-val., the null hypotheses is rejected, which means there is significant difference between the achievement of males and females with regards to discovery method, this is line with the findings of Rodd and Bartholomew (2006), Hyde, Fenneman and Lamon (1990), Ridley and Novak (1983) and Scott-Hodgetts (1986).

Conclusion

On the basis of these findings in this study, the following conclusions were drawn:

- Students taught through discovery method achieved better than those taught by traditional method.

- There exists a significant difference in the achievement of mathematics students taught through discovery method and traditional method.

- Difference between the achievements level is due to discovery strategy, otherwise both group have equal basic knowledge of mathematics.

Recommendations

The following recommendations were made on the basis of the findings of the study:

- This study proved that discovery strategy is more effective method of instruction for teaching and learning mathematics as compared to traditional (lecture) method of teaching. Therefore the teachers of mathematics should use discovery method to improve the academic achievements of the students.

- Government should transform the textbooks of mathematics in discovery learning form. Because the traditional textbooks do not meet the criteria of discovery approach.

- Extensive training program, seminars and workshops should be organized for mathematics teachers in senior secondary schools to employ discovery method in the classrooms.

REFERENCES

Battista, M. T. (1999). The Mathematical Mis Education of American's www.pdkintl.org/kappan/kbat9902.htlm 55k 4 search on 15-11-2006

Chang, S. C., Kaur, B., Koay, P. L. & Lee, N. H. (2001).An exploratory analysis of current pedagogical practices in primary mathematics classrooms. *The NIE Researcher, 1(2), 7-8*

Hyde, J. S., Fenneman, E., H., & Lamon, S. J. (1990). Sex differences in mathematics performance: A meta-analysis, *Psychological Bulletin, 107(2), 139-155*

Krejcie, R. & Morgan, D. W. (1970). "Determining Sample Size for Research Activities", Educational and Psychological Measurement.

Lerch, H. & Hamilton, H. (1970).A Comparison of a Structured Equation Approach to Problem-solving with a Traditional Approach in Ash lock (Ed).Current Research in Elementary School Mathematics. The Macmillan Company New York, PP.211-216

Luzmanuel, S. T. (1990). Mathematical tasks and student cognition: Dissertation Abstract. http://www.ntef.com/html/lib/unil/192197.html search on 15-08-2006

Nuzum, M. D. (1991). The Effects of Instructional Model Based on the Information Processing Paradigm on the Disabled Students in Siddiqui, M.H. (Ed). Model of Teaching Theory and Research. Ashes' Publishing house Punjab Bagh New Delhi India. P. 84

Ormrod, J. E. (2000). Educational psychology: Developing learners (3rd ed.). Upper Saddle River, NJ: Merrill-Prentice Hall.

Richards, J. (1991).Mathematical discussions in Evonglaserfeld (ED), Radical constructivism in mathematics education. pp 13-51. Dordrecht, the Netherlands.

Ridley, D. R., & Novak, J. D. (1983). Sex related differences in high school science and mathematics enrolments: Do they give males a critical head start toward science- and math-related careers? *The Alberta Journal of Educational Research, 29(4), 308-318.*

Rodd, M. & Bartholomew, H. (2006). Invisible and special: Young women's experiences as undergraduate mathematics students. *Gender and Education, 18(1), 35-50*. doi: 10.1080/09540250500195093

Scott-Hodgetts, R. (1986). Girls and mathematics: The negative implications of success. In L. Burton (Ed.), *Girls into Maths Can Go* (pp. 61-76). London: Rinehart &Winstone.