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Effectiveness Of Group Discussion And Problem Based Learning On Students' Academic Performance In Mathematics; A Panacea For Societal Transformation

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Abstract
This study investigated the effectiveness of group discussion and problem based learning on students' academic performance in mathematics; a panacea for societal transformation in Ondo State. The study employed a pre-test, post-test, control quasi experimental design. The sample consisted of 180 senior secondary school II (SSS 2) students. Multistage sampling technique was used to select the sample for the study. The instrument used for the study was Mathematics Performance Test (MPT). The face and content validity of the instrument was ascertained while test re-test method was used to ensure the reliability which yielded reliability coefficient of 0.81. Data collected were analysed inferentially with Analysis of covariance (ANCOVA) for null hypotheses all at 0.05 level of significance and post hoc test to examine the effectiveness of group discussion and problem based learning on the learning outcome. It was found that the combination of group discussion and Problem based learning contributed more significantly in enhancing the learning outcome of the students in mathematics. Also, the result of this study revealed that gender has no effect on students' performance in mathematics. Based on the findings it's recommended that mathematics teachers should encourage their students to learn problem based learning methods with group discussion which will be of immense benefit in improving academic performance of students in mathematics as panacea for societal transformation.

Keywords*: Group discussion, Problem Based learning, Performance, Mathematics, Prospect*

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I. Introduction

Today, mathematics has a key role in society transformation and economic development in developed communities. For society to develop economically, socially, politically and technology, she must be able to train large number of the much-needed human resources. If a sound basis for a technological society must be created, then there should be a thorough understanding of scientific studies among our youths. To develop such sound basis for modern technology, the acquisition of mathematical abilities, which facilitates the appropriate technological orientation, must be provided for successful generations. Mathematics education is needed to expedite technological advancement. Kolawole (2004) described Mathematics as the backbone of a nation and as an instrument that facilitates the learning of all subjects. For this reason, the teachers should be a guide for students in order to put themselves into discipline, to achieve self-control and have self- motivation (Anderson, 2004). On the other hand; technology plays a significant role in the development of the educational process. Rapid development of information technologies has led to the birth of information societies and made it necessary for societies to follow it and adjust themselves to new technological advances. The rapid increase in information and the number of students have brought about several problems and these new technologies has taken a part in the development of educational process and the quality imposed into the educational institutions has become compulsory. Educational technology has played a key role in inclusion of new technologies in educational process.

The importance of Mathematics to human development attracted different comments, for instance, Cangiano (2009) described it as the queen of science and the language of nature and argued that its importance should be clear to any reasonable person. Constructivism is a learner-centered approach and evolved as a solution to the problems mentioned above. Constructivist approach is that there is no correct ‘‘meaning" of the world that we are struggling to understand. Instead, there are many ways to structure the world, and there are many meanings or perspectives for any event or concept. In other words, learning takes place as a result of discussion based on evidences guided by the socio-cultural context and constructing a personal information network via adaptation and placement (Simsek, 2004).

One of the important methods of constructivist approach is problem-based learning (PBL) approach. Problem based learning is an approach for structuring curriculum content, facing students with problems from practice, which provides a stimulus for self-directed learning of students following defined steps. Problem-based learning (PBL) is a method that challenges students for working cooperatively. It prepares students to think critically and analytically, and to find and use appropriate learning resources.

Problem-based learning means cooperative learning starting off with a problem. The problem is in the centre of the focus should foster a process among the students of assessing and discussing the issues of the problem. The goal is to activate prior knowledge of the students and to help them to start a learning process by reconstructing their knowledge and making new sense of it. In the academic domain, numerous studies have been conducted to examine the influence of gender on students' academic performance. While some researchers (Afuwape and Oludipe 2008; Abd Raheem, 2012) found that gender has no significant influence on student's satisfaction levels, others (Ismail and Othman, 2006; Farooq, Chaudhry, Shafiq & Berhanu 2011) found a significant effect for gender, with female having significantly higher perceived academic effort. However, previous studies on gender effect in learning appear inconclusive. This has necessitated the need to find out if there are significant differences between male and female academic performance. Thus, this study examines the moderating influence of gender on students' civic education outcome of pre-service teachers using case-based and scenario method of instruction. The theoretical foundation upon which this study is built can be found in constructivist theories. This theory could support 'interactive modelling' for peace education in order to promote positive changes in the values orientation of the learners. Social constructivism is strongly influenced which suggested that knowledge is first constructed in a social context and is then taken up by individuals (Kauchak, 2004). In Social constructivism, the process of sharing each person's point of view—called collaborative elaboration (Meter & Stevens, 2000). The relevance of social constructivist theory resides in the fact that it support peace education pedagogy which is expected to be interactive, participatory and dialogical using such methods as group discussion, problem based learning, problem-cased based learning, brainstorming, cooperative learning projects, problem-solving frameworks, alternative future exercises, and case studies of peace movements across the globe in order to foster critical thinking (Readon & Cabezudo, 2002). Social constructivist approaches can include reciprocal teaching, peer collaboration, cognitive apprenticeships, problem-based instruction, webquests, anchored instruction and other methods that involve learning with others (Shunk,2000). Procedure in implementing problem based learning in classroom The teacher Identifies and clarifies unfamiliar terms presented in the scenario, the teacher define the problem or problems to be discussed, aspects on basis of prior knowledge are collected, formulating learning objectives; group reaches consensus on the learning objectives; tutor ensures learning objectives are focused, achievable, comprehensive, and appropriate. Self-independent learning; during this phase students are go home and study.

Another interactive method speculated in this study is group discussion method (GDM). Group work is centered upon the constructivism model of learning Piaget, (2013).

The group discussion method is considered by modern educators as the anticipation of learners in the process of learning, and of the 'thinking together' process, though which points of view are evaluated, issued raised, and solution are sought based on the study. The solutions are subjects to further examination and group analysis under the guidance of the teacher. Akinlaye (2002) viewed group discussion method as a method organized on the rationale that the knowledge and ideas of many people if pooled together, are more likely to find solutions or answers to specific social issues or problems. Such solutions, therefore, have greater merit than those of a single person, for common decision making and social action. Group work plays a fundamental role both in cooperative and in collaborative learning methods, and has attracted significant research interest. Johnson (2014). The procedures in group discussion are: Teacher gives the introductory definitions of issues/problem or topic for discussion through clear and simple opening questions to the class. Teacher then divides the class into groups and assigns the issue/topic to each of the groups for their preparation and facts/information findings, the group leaders take over and control group discussion sessions, and record all vital points as discussed, whole class meet to consider group leaders' reports, to lead to whole class reconciliation of difference and agreement for conclusion. Whole class and teacher reach consensus, conclusion on summarized point, and then, take decision for action. Some experts have advocated for the use of direct instruction in the teaching of peace education, others believe that problem based learning strategies can inculcate the desired culture of peace in people and as well be able to implement "catch them young" policy through problem based learning and group discussion techniques. Therefore, this study focus on the effectiveness of group discussion and problem based learning on students' academic performance in mathematics; a panacea for societal transformation.

Statement of the Problem

This study attempt to investigate the effectiveness of group discussion and problem based learning on students' academic performance in mathematics; a panacea for societal transformation. For the study of

Mathematics to attain practical significance and high utility in a society aspiring for rapid scientific and technological advancement, it has to be pursued well beyond the basic or general level. Every society aiming at attaining high knowledge of science and being functional in the society must possess an average knowledge of mathematics. The rate at which students are failing in external examination in mathematics is alarming.

Purpose of the Study

The purposes of this study is to examine the effectiveness of group discussion and problem based learning on students' academic performance in mathematics; a panacea for societal transformation.

Research Hypotheses

The following null hypotheses were generated to assist the research work:

1. There is no significant difference between the mean score of students exposed to group discussion method and problem based learning methods combined and those not so exposed.
2. There is no significant difference between the mean score of male and female students exposed to group discussion method and problem based learning combined.

II. Methodology

The study adopted quasi experimental design. The s ample consisted of participants drawn from three senatorial zones of Ondo State. The target population for this study consisted of all public secondary schools in Ondo State. A sample of 180 senior secondary school II (SSS2) students were selected using Multistage sampling procedure. One local government was selected from each senatorial district. Two schools were selected from each local government using simple random sampling techniques. The research instrument for this study was self-designed by the researchers. Tagged "Mathematics Performance Test" (MPT). The face and content validity of the instruments was done by the experts in Mathematics and it was also presented to Test Measurement and Evaluation experts. While the reliability was determined by using test re-test method and analysed by using Pearson's Product Moment Correlation Analysis which yielded 0.81 reliability coefficients. The research assistants were employed to administer the instrument and collected. The data collected was analysed inferentially using analysis of covariance (ANCOVA) all at 0.05 level of significance.

III. Results

Hypothesis 1: There is no significant difference between the mean score of students exposed to group discussion method and problem based learning methods combined and those not so exposed.

Table 1: ANCOVA showing students' performance in group discussion and problem based learning groups

Source	SS	df	MS	F_{cal}	P	F_{table}
Corrected model	21578.628	2	10789.314	35.791	0.000	3.00
Covariance (pretest)	5095.028	1	5095.028	16.901	0.000	3.84
Group	15548.096	1	15548.096	51.576	0.000	3.84
Error	47328.747	177	301.457			
Corrected total	68907.375	179				
Total	1703088.000	180				

Table 1 shows that there is significant difference between the means scores of students exposed to group discussion and problem based learning methods combined and those not so exposed ($F= 51.576$, $P<0.05$). The null hypothesis is rejected. The result of Multiple Classification Analysis (MCA) is presented in table 2.

Table 2: Multiple Classification Analysis (MCA) of students' Performance by treatment

Grand Mean = 101.06					
Variable + Category	**N**	**Unadjusted Devn**	**Eta**	**Adjusted for independent + Covariate**	**Beta**
Group discussion + Problem based learning	120	12.15	.54	9.68	.30
Control	60	-10.15		-9.64	
Multiple R^2					.087
Multiple R					.286

Table 2 shows that students exposed to group discussion and problem based learning methods had the higher adjusted means score o 113.21 (101.06+12.15) than those not exposed with an adjusted mean score of 90.91 (101.06 + (-10.15)). This implies that used group discussion and problem based learning enhance s

students' performance in Mathematics.

Hypothesis 2: There is no significant difference between the mean score of male and female students exposed to group discussion method and problem based learning combined.

Table 3: ANCOVA Summary of students' performance by gender and treatment

Source	SS	df	MS	F_{cal}	P	F_{table}
Corrected model	10589.024	4	2647.256	95.676	0.000	2.37
Covariate (Pre-Test)	71.855	1	71.855	2.597	0.109	3.84
Gender	8.278	1	8.278	.299	0.585	3.84
Group	104848477.866	1	10477.866	378.688	0.000	3.84
Gender + Group	124.959	1	124.959	3.516	.530	3.84
Error	4288.670	175	27.669			
Corrected total	14877.694	179				
Total	93333.000	180				

P>0.05

Table 3 shows that there is no significant difference between the performance mean scores of male and female students exposed to group discussion and problem based learning methods combined (F= 3.516, P>0.05). the null hypothesis is not rejected, similarly, the main effect of gender (F= 0.530, P>0.05) on the performance of subject is not statistically significant at 0.05 level of each case.

IV. Discussion

This study examined the effectiveness of group discussion and problem based learning on students' academic performance in mathematics; a panacea for societal transformation the combination of group discussion and problem based learning method had significant difference in the students' performance in mathematics. This was supported by Oladosu (2011) in her opinion which says, every good teacher should know that students do not learn in the same way, so teacher need to use different teaching methods in order to reach every students effectively.

Also, Harris (2001) expressed that a variety of teaching methods, a knowledge of student level and implementation of which strategies are best for a particular student can help the teacher to know which teaching methods will be most effective for his class. The study also found the interaction effect of performance mean score of male and female students expose to treatment. The result revealed that the null hypothesis was not rejected. That is, there was no significant interaction effect of gender by treatment. This was in support of (Afuwape and Oludipe 2008; Abd Raheem, 2012) found that gender has no significant influence on student's satisfaction levels. This was in contrary to (Ismail and Othman, 2006; Farooq, Chaudhry, Shafiq & Berhanu 2011) found a significant effect for gender, with female having significantly higher perceived academic effort. Falade, (2007), Fakeye, (2010), Ogunbiyi and Soluade (2011) found that gender has a significant effect on the subjects performance with male students performing better than their female counterparts. This showed that sex had no effect on the performance of students towards the learning of Mathematics.

V. Conclusion

Based on the findings, it was concluded that both group discussion and Problem based learning methods were effective for teaching of Mathematics. It was concluded that gender has no impact on the effectiveness of group discussion and problem based learning method of teaching. Any of the methods or the combination of the two could be used for effective teaching and learning of Mathematics and this will enhance societal transformation.

VI. Recommendation

Mathematics teacher should be educated for effectiveness concerning the principles, techniques and rules guiding the usage of group discussion and problem based learning method. Regular seminars and workshops should be given by experts on the use of problem based learning and group discussion. Students should be given orientation concerning problem based learning and group discussion for proper societal transformation.

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