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THE EFFECT OF GROUP GUIDED DISCOVERY APPROACH ON THEPERFORMANCE OF STUDENTS IN GEOMETRY

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Abstract:

This study aims to examine the effect of group guided discovery approach on the performance of students in Geometry of Malinta National High School for school year 2012-2013. The study used the quasi- experimental approach with non-equivalent control group pretest/posttest design. The sample of the study consisted of 92 students, half of whom were taught using the group guided discovery approach, and the other half using the traditional lecture approach of teaching. The experiment lasted for two months during the fourth grading period. To determine the mathematical performances between the defined groups the percentage, mean, and the t- test for dependent and independent means were used. The study showed that the performance in Geometry of those students taught using group guided discovery was significantly higher than those students taught using the traditional lecture approach. Thus, the study concluded that group guided discovery approach was more effective than the traditional approach.

Index Terms: Group Guided Discovery, Discovery Approach & Performance in Geometry

1. Introduction:

According to Plato, as cited by Static (1986), those who are by nature good at calculation, as one might say, are naturally sharp in every study and those who are less adept at it, if they are educated and trained in this study, nevertheless improve and become sharper than they were (Indiogine, 2009). In other words, mathematics has a great influence in all areas of studies. In fact, De Leon (2004) claims that mathematics education is the window to success, understanding, appreciating, and accepting diversity.

A number of methods to improve the performance of students in mathematics have been discussed such as experimentation, cooperative learning, questioning, repetition, and manipulation. Some of them are recommended for application, others are disapproved and some have been recommended for use but with caution. The teacher has to make his/her own choice based on the available methods.

Salazar (2008) claimed that students learn best if they are allowed to think rather than just to read and to listen. She further argued that students learn and achieve more, behave better, and like learning better when they are permitted to learn through their sociological preferences.

Many researchers such as Brosnahan (2001) and Mayer (2004) have recommended that traditional ways related to teaching should be substituted by more innovative ones. Among those innovative strategies are guided discovery, which is based on the extent of students' involvement in classroom activities under the guidance of the teacher and how much the teacher activates student's thinking processes.

Since guided discovery is a student-centered activity, it would be difficult for some students to adjust to it because some are less competent and others lack confidence in their own ideas. Guided discovery is also time-consuming (Domitrascu,

2004). Therefore, to solve this problem, students must work in groups.

According to De Leon (2004), group brainstorming sessions bring several minds together to work on a problem, thus increasing the chances that a fruitful idea will come up. Even when a student first gets an idea from another student, he/she sees the idea in the context of intense thought about a problem. Usually the idea is only partly formed when it comes up in a brainstorming session, so the students must complete it either as a group or on their own. Thus students have the tendency to learn better from an idea they first met in a group brainstorming session than they first encounter in a lecture.

In this study, the researcher considered the two strategies- the group work and guided discovery approach to find out if these teaching strategies in teaching Geometry will improve students' proficiency in Geometry. The combined strategies were called the group guided discovery approach.

The group guided discovery approach using the concepts learned from lectures and other researches inspired the researcher to engage in this study. This research is geared towards the improvement of students' performance not only in Geometry but also in other branches of Mathematics.

2. Conceptual Framework:

Figure 1 shows the study's conceptual framework, including the stages of guided discovery and the relationship between and among the different stages.

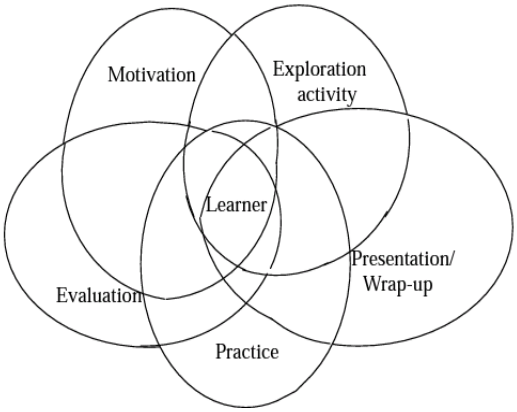

Figure 1: Study's Conceptual Framework

- **Motivation:**

In this stage, the teacher posed initial questions to prepare the students for the lesson. The teacher helped the students to recall information from their own experience to link the previously learned material with the new subject matter. This stage is very essential to get the students' attention and to help in bridging the gap in learning by activating students' prior knowledge for them to absorb the new material.

- **Exploration Activity:**

The students worked in groups. During the group work, the teacher went around from group to group, listened to their discussions, encouraged them if the direction was right or otherwise asked questions to steer them on to a more productive path, requested more details or further justification. At this stage, each member of the group held a copy of the activity sheet. On their own the students discussed ideas that emerged within the group as they worked through the activity sheet. The activity sheets were checked after the presentation to ensure participation of each member and corresponding points would be given. Students were asked to compile the activity sheet in a portfolio. Once students had worked through the activity sheet successfully, the class was ready to move onto their presentation.

- **Presentation**:

This was the stage where the students discussed their solution tothe problem to the class. In each activity, one member of the group was required to present and discuss their answers.

- **Wrap Up**:

The wrap up came after one objective of the lesson was presented by group/groups followed by other group/groups for other objectives to make sure that the students clearly see and meet the objective of the lesson. The teacher guided the students through follow-up questions.

- **Practice:**

Here, an extension of concepts and generalization of ideas was necessary. The students were given another problem to ensure mastery of the lesson.

- **Evaluation**:

The teacher measured the understanding of the students through the pencil and paper researcher-made test. The test consisted of multiple choice, identification, and problem-solving items. Each lesson took two to three days to complete. The first day was devoted to the motivation or review and was followed by the exploration of the activity. In the second day or third day the students presented their output before the wrap-up, practice, and evaluation.

Statement of the Problem:

This study was conducted to determine the effect of group guided discovery approach on students' performance in Geometry. Specifically, this study sought to answer the following questions:

- ✓ What are the mathematical performances of the students who belong to the control group and the experimental group before and after the use of group guided discovery method and traditional lecture method?
- ✓ Is there a significant difference between the pretest mean scores of the experimental and control groups?
- ✓ Is there a significant difference between the pretest and posttest mean scores of the
  - Control Group; and
  - Experimental Group?
- ✓ Is there a significant difference between the posttest mean scores of the experimental and control groups?
- ✓ What are the implications of group guided discovery on the students' performance towards geometry?

Scope and Limitation of the Study:

This study was conducted in Malinta National High School, a public school located at St. Jude Subd., Malinta, Valenzuela City. The respondents selected were third year students of academic year 2012-2013, who belonged to two heterogeneous sections. This study covered two topics, namely circles and plane coordinate Geometry.
The researcher would like to find out the effectiveness of group guided discovery method of teaching on the performance of students' in Geometry. This research was limited to the information gathered from the achievement test used to determine the students' performance.

3. Methodology:

The researcher adopted a quasi-experimental approach using non-equivalent control group pretest/ posttest design because in this study the participants were not randomly assigned. According to Harris et al. (2006) quasi-experiments are studies that

aim to evaluate interventions that do not use randomization. Similar to randomized trials, quasi-experiments aim to demonstrate causality between an intervention and an outcome. Two sections of third year students were used in the study. One section, the experimental group, was taught using the group guided discovery approach. The other group, the control, was taught using the traditional lecture method.

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Participants of the Study:

The 92 participants of this study were third year high school students taking Geometry in Malinta National High School (MNHS), a public school located inside St. Jude Subdivision of Malinta, Valenzuela City with a population of about 3000 students. It has large class sizes, high dropout rate and inadequate facilities, equipment, and materials. The research covered the fourth grading period of school year 2012-2013.

Research Instruments:

The research instruments used in this study were as follows:

- **Achievement Test:** The table of specification for the achievement test was constructed (see Appendix A). The total items were 30, 18 for easy items which is equal to 60% percent of the items, 9 for average items which is equal to 30% of the items and 3 for difficult questions which is 10% of the items. The achievement test(see Appendix B) which is used as pretest and posttest was content-validated using item-analysis procedure (see Appendix C).The test is also face-validated by a master teacher of Mathematics, a head-teacher of Mathematics and a teacher III in Mathematics (see Appendix F). The head teacher of Mathematics suggested to change some items in question form. The master teacher and the teacher III in Mathematics asked the researcher to reconstruct confusing items.
- **Guided Discovery Sheets-** Guided discovery sheets (see Appendix D) were prepared by the researcher. The guided discovery sheets were based on the lesson guides in Geometry prepared by Ateneo De Manila University. The researcher prepared 9 activity sheets or 9 lessons for the fourth grading. The coverage of the lesson was the fourth grading period wherein the topics were Circles and Plane Coordinate Geometry. The researcher asked her head teacher and one English teacher to check the lesson plan for its validity. The head teacher did some corrections on the content of the activity sheets and the English teacher did some corrections on the grammar of the activity (see Appendix I). Also the researcher tested the activity first to students not under the study. After this, the researcher made the necessary modifications and adjustments.

Evaluation Scores:

To get the scores for evaluation, each response was given a point value. The corresponding value of each score was as follows:

Table 1: Interval and Corresponding Verbal Interpretation of Mathematical

Performance

Scores	Verbal Interpretation
25-30	High Performance
19-24	Above Average performance
13-18	Average Performance
7-12	Below Average Performance
1-6	Low Performance

Table 2: Interval and Corresponding Verbal Interpretation of Group Performance on Group Guided Discovery

Scores	Interpretation
10 points	Met or exceeded the expectation for the objective of the lesson.
8 points	Presentations were well-prepared, missed some key ideas.
6 points	Presentations were adequate, but required more work to meet the standard expectation.
4 points	Presented outputs but only gave few correct answers.
2 point	Presented outputs but did not contribute or give correct answer.
0 point	No presentation of output.

Table 2 shows the corresponding score of the performance of each group (Domitrascu, 2004).After the presentation of the activity by the students, the teacher evaluated their group performance based on their presentation by using the rubric above.

Data Gathering Procedures:

The researcher sent a letter of permission to the principal to conduct the study during the fourth grading period (see Appendix A). The table of specification was constructed for two topics: the Circle and Plane coordinate Geometry. The researcher-made 50 items which were tried out to 50 fourth year students, and only thirty items were retained from the 50 items (see Appendix C).The questions were adopted from a textbook in Geometry, the teacher's resources and some materials in the internet. The students who were under the study were the sections with closest mean score during the diagnostic test done before the start of classes. Before the fourth grading III- Daniel and III- Jeremiah were pretested to determine their knowledge of the subject. The lesson for each subject matter took two days. The first day focused on motivation and group activity. On the second day, the activity allowed each group to present their group work and their presentations scored (see table 5), followed by a wrap up for teachers and students and evaluation or seat works. After 9 lessons within two months of instruction, a posttest (see Appendix A) on Geometry was administered to the respondents. The pretest and posttest used the same test so that the degree of learning could be directly measured.

Statistical Treatment of Data:

In order to facilitate the accuracy and reliability of interpretation of the data, the following statistical tools were used.

- **Percentage:** It is used to describe the relationship of a part from the whole. The researcher used this to determine the profile of the students.
- **Mean and Standard Deviation:** It is used to represent the level of performance of the respondents in Mathematics before and after the learning unit and the use of group guided discovery.
- **T-test for Dependent Samples:** This was used to find if there is a significant

difference between the pretest and posttest scores of the experimental group and the pretest and posttest scores control groups in the performance test.

- **T-test for Independent Samples:** This was used to find out if there is a significant difference between the pretest scores of the experimental group and control group and posttest scores of the experimental group and control group in the performance test.

4. Presentation, Analysis, and Interpretation of Data:

Problem 1: What are the mathematical performance of the students who belong to the control group and the experimental group before and after the use of group guided discovery method and traditional lecture method?

Table 3 shows the distribution of the mathematical performance of respondents who belong to the control group.

Table 3: Frequency Distribution of the Respondents According to Pretest and Posttest of the Control Group

Scores	Interpretation	Control Group			
		Before		After	
		F	%	F	%
25 – 30	High Performance	0	0	5	10.87
19 – 24	Above Average Performance	0	0	10	21.74
13 – 18	Average Performance	15	32.61	21	45.65
7 – 12	Below Average Performance	31	67.39	10	21.74
1 – 6	Low Performance	0	0	0	0
Total		46	100	46	100
	Mean		**9.46**		**14.80**

A careful examination of table 3 shows that before the learning unit, 15 out of 46 or 32.61% of the respondents had average mathematical performance; 31 out of 46 or 61.39% had below average performance level. All the respondents had a mean score of 9.56 which indicated below average performance in Mathematics before the learning unit.

Table 3 also shows that after two months of learning the concept of Geometry, particularly the circles and plane coordinated geometry, the students in the control group had increased their performance from a mean score of 9.46 to 14.80. Five (5) out of 46 or 10.87% of the respondents registered high performance; 10 out of 46 or 21.74% of the respondents remained above average mathematical performance; 21 out of 46, or 45.65% of the respondents had average performance; 10 out of 46 or 21.74% got below average performance. None of the students who belong to the group got low in mathematical performance. The control group had an average performance as indicated by the mean score of 14.80%.

Table 4 shows the distribution of the mathematical performance of respondents who belong to the group guided discovery.

Table 4: Frequency Distribution of the Respondents According to Pretest and Posttest of the Experimental Group

Scores	Interpretation	Experimental Group			
		Before		After	
		F	%	F	%
25 – 30	High Performance	0	0	11	23.91
19 – 24	Above Average Performance	0	0	23	.50
13 – 18	Average Performance	15	32.61	10	21.74
7 – 12	Below Average Performance	28	60.87	2	4.35
1 – 6	Low Performance	3	6.82	0	0
Total		46	100	46	100
	Mean		**9.07**		**19.11**

Table 4 shows the mathematical performance of the experimental group before the learning unit and treatment. Initially, 15 out of 46 or 32.61% of the respondents had average mathematical performance; 28 out of 46 or 64% had below average performance in Mathematics; 3 out of 46 or 6.82% of the respondents had low performance in Mathematics. Collectively, they had a mean score of 9.07, which also indicated a below average mathematical performance.

After the treatment (group guided discovery approach) was used in the experimental group, the researcher administered a posttest. Eleven (11) out of 46 students got high mathematical performance or 23.91% of the students; 23 out of 46 or 50% of the students had above average mathematical performance; 10 out 46 or 21.74% of the students received average performance in Mathematics. However, two (2) out 46 or 4.35% remained below average mathematical performance. None of the students who belonged to the group scored low in their mathematical performance.
The experimental group had an above average mathematical performance as indicated by a mean score of 19.11.

Problem 2: Is there a significant difference between the pretest mean scores ofthe experimental and control groups?

Table 5 shows the comparison of the pretest of the control and experimental groups on the performance test.

Table 5: Comparison of the Pretest Mean Scores on the Performance Test of the Experimental and Control Group

Control Group III- Jeremiah		Experimental Group III- Daniel		T-test value	Critical Value at =.05	Verbal Interpretation
SD	Mean	SD	Mean			
2.81	9.46	3.45	9.07	0.0842	1.645	Not Significant

It can be viewed from the table that the computed t-value is less than the critical value of 1.645 at 0.05 level of significance. This means that in terms of prior knowledge there is no significant difference in the Mathematics performance of the students in the

control and experimental groups. This indicates that the experimental and control groups were comparable at the start of the study.

Problem 3: Is there a significant difference between the pretest and posttest mean scores of the experimental and control groups?

- **Control Group**
- **Experimental Group**

Table 6 shows the comparison of the pretest and posttest of the control groups on the performance test. Table 6 shows the comparison of the pretest and posttest of the control groups on the performance test.

Table 6: Comparison of the Pretest -Posttest Mean Scores on the Performance Test of the Control Group

Pretest		Posttest		T-test value	Critical Value at □ =.05	Verbal Interpretation
SD	Mean	SD	Mean			
2.81	9.46	5.50	14.80	5.89	1.645	Significant

As shown on the table above, the computed t-test value of 5.89 is beyond thecritical t-test value of 1.645 at □ =.05 with degrees of freedom equal to 90. This means that the pretest scores differed significantly from the posttest scores of the control group on the performance test. Table 7 shows the comparison of the pretest and posttest of the control groups on the performance test.

Table 7: Comparison of the Pretest -Posttest Mean Scores on the Performance Test of the Experimental Group

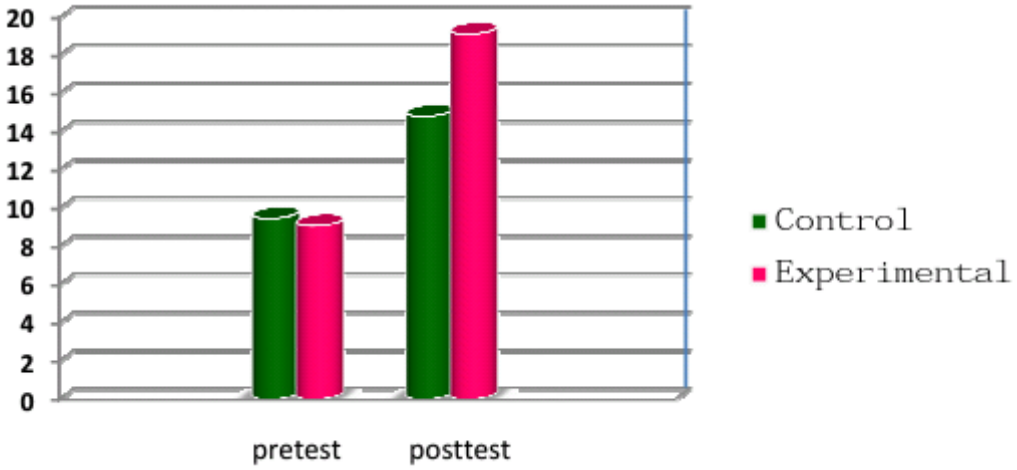
Pretest		Posttest		T-test value	Critical Value at □ =.05	Verbal Interpretation
SD	Mean	SD	Mean			
3.45	9.07	4.87	19.10	11.40	1.645	Significant

As shown on the table above, the computed t-test value of 11.40 is beyond the critical t-test value of 1.645 at □ =.05 with degrees of freedom equal to 90. This means that the pretest scores differed significantly from the posttest scores of the experimental group on the performance test. Clearly, it is an indication that the performance of the respondents after the experiment improved. This indicates that the performance of the participants after the experiment improved significantly regardless of the treatment given.

Control Group and Experimental Group:

Figure 3 above illustrates the big improvement in the scores of the experimental group compared to the control group in the pretest and posttest. It shows that students in the experimental group performed better than in the control group.

Figure 2: Graph of Mean Scores of Pretest and Posttest of the Groups



Problem 4: Is there a significant difference between posttest mean scores of the experimental and control groups?

Table 8 shows the comparison of the posttest mean score of the experimental and the control groups on the performance test.

Table 8: Comparison of the Posttest Mean Scores on the Performance Test of the Experimental and Control Group

Control Group III- Jeremiah		Experimental Group III- Daniel		T-test value	Critical Value at =.05	Verbal Interpretation
SD	Mean	SD	Mean	5.46	1.645	Significant
5.50	14.80	4.87	19.10			

As shown on the table above, the computed t-test value of 5.46 is beyond thecritical t-test value of 1.645 at =.05 withdegrees of freedom equal to 90. This means that there was a significant difference in the posttest means score on the performance test of the two groups. The performance of the students in the experimental group was better than the performance of the students in the control group.

Problem 5: What are the implications of group guided discovery on the students' performance towards geometry?

The results of the study suggest that, group guided discovery approach is an effective teaching strategy for Geometry. The result of pretest and posttest mean scores showed a significant difference between the performances of the students of experimental group and the students of the control group. Students among the group guided discovery had higher scores compared to those students who underwent the traditional method of teaching. As one of the students said, "I like the group guided discovery because I personally discover the answer and sometimes with the help of my classmate. It is exciting because the questions help me to think and become responsible learner". Another student also said, "At first I don't like the method because it was difficult but later I enjoyed it because I experience to do a lot of errors which help me to remember the right answer".

Students learn better when they are led through activities that allow them to discover concepts for themselves (guided discovery) than from the presentation of concepts by an instructor.

It was observed that students were motivated in learning through the activity. This is because the students worked cooperatively thus they helped one another and shared their own ideas in a certain topic. One student said, "I like to be in a group because I feel good when I share my ideas". Other said, "I am afraid to ask question during class discussion because I am not comfortable to open it to the teacher but with group work, I can ask the things I can't understand from the question".

The group guided discovery methods of teaching helped the students to be active learners and that's why retention is better as shown in their mathematical performance after the intervention.

5. Summary of Findings:

The initial mathematical performance of the students was below average as shown by the pretest results. After the learning unit and the use of intervention (group guided discovery approach), the control group had an average performance while the students who belonged to group guided discovery increased their mathematical performance from below average to above average. A significant difference on the mathematical performance of students between the control group and experimental group was registered in the computed t-test value of 3.98 which was beyond the critical value of 1.645 at 0.05 level of significance with 90 degrees of freedom. The students who belonged to the group guided discovery performed significantly better than those students who belonged to the control group. Consequently, the group guided discovery proved to be an effective intervention to help the students become active learners.

6. Conclusion:

Based on the findings of the research, the following conclusions were reached:

- ✓ The group taught using guided discovery approach performed better in Mathematics than the group taught using the traditional lecture method.
- ✓ The use of group guided discovery approach significantly and positively affects the performance of the students in Geometry.
- ✓ Students are more interested and motivated to do the activities in group guided discovery.

7. Recommendations:

On the basis of the findings and conclusions of this research, the following recommendations are offered:

- ✓ Teachers should attend seminars, workshops, conferences, and other professional development gatherings particularly those related to construction of guided questions as a part of group guided discovery approach.
- ✓ Mathematics teachers should devise and implement group guided discovery approach to further improve students' performance in Mathematics.
- ✓ Further researches should be conducted on the effectiveness of group guided discovery at different year levels to verify the result of this study.

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