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Research Article

Project - Based Learning Approach in Teaching: Enhancing Problem Solving Skills of Senior High School Students

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Abstract

The main purpose of this study was to determine the effectiveness of the Project-Based Learning Approach in the concepts of conic sections (circle, parabola, hyperbola, and ellipse) to the thirty (30) students of Grade Eleven-Tourmaline of President Quirino National High School - Senior High School. The set of thirty-item (30) questionnaire was used for the conduct of pretest and posttest. And, the students' performance rubric was used to assess the student's presentation of their outputs. This study applied experimental design specifically using one-group pretest-posttest design. The results of the pretest and posttest were subjected to statistical treatment to determine if there is significant difference where two-tailed t-test was used as a statistical tool at 0.05 level of significance. Based on the findings, the pretest and posttest result of the focus group has significant difference in which the hypothesis is rejected. This implies that the use of Project-based Learning approach in learning conic sections is effective.

Keywords: Project-Based Learning Approach, ProblemSolving Skills, Conic Sections

Introduction

One of the best ways to promote global competitiveness in the Philippines is to upgrade Teachers in teaching Mathematics education nationwide. Math should be taught in a more practical manner, and showing its relation to everyday life that they can use to deal with abstract concepts.

Mathematics is a subject that students often find abstract and, therefore, they may struggle to find its relevancy in their own lives (Uyangor, 2012). And, many students were reported to face difficulties in mathematics particularly in mathematics problem solving (Tay Lay Heong, 2013). If teaching and learning process is not equally effective for all students, the difficulties in acquiring mathematics skills by the students could get worsen (Stendall, 2015)

Students have different intellectual capacities and learning styles that can hinder or benefit knowledge acquisition. Teachers should employ many approaches and strategies to effectively understand which approach best suit the learning of the student. The importance of developing students' problem solving skills is being exerted.

Salandanan (2012) stated that teachers have to give the students opportunities to participate in classroom activities to the students for "hands-on-minds-on" learning. The researchers found out that the most effective approaches-resulting in 75 percent and 90 percent retention rates, respectively are learning by doing (such as through inquiry method) and learning by teaching others.

It is the teacher who will ensure the development of those skills in students. So it is appropriate or important for teacher candidates to familiarize themselves on ways to develop their problem solving skills as well as their instructional methods, and techniques that will enable them to develop these skills in their students.

One of the best ways that can be used to develop the person's problem solving skills is the Project-based Learning (PBL) approach. PBL's student-centered approach allows students to take control of their learning and it has a key focus on integrating the development of content knowledge and 21st century skills such as collaboration, problem solving, critical thinking, inquiry, and communication (Larmer & Mergendoller, 2016). Additionally, PBL engages learners in a complex activities. It requires several steps, a longer period of implementation and cooperative group learning. They generally require learners to organize their activities, conduct research, solve problems, and synthesize information (Bentillo, et. al, 2018).

This study is designed to determine the teachers' teaching Project-Based Learning Approach in the concepts of conic sections (circle, parabola, hyperbola, ellipse) - a content standard of Pre-Calculus subject at President Quirino National High School. In connection

with this, a study was conducted to determine the effectiveness of Project-Based Learning Approach in Pre-Calculus for enhancing the problem solving skills of the senior high school students.

Research Questions

The mainly purpose of this study was to determine the effectiveness of the Project-Based Learning Approach in the concepts of conic sections (circle, parabola, hyperbola, ellipse) among the students of President Quirino National High School - Senior High School. Specifically, this study attempted to determine the performance of the students based on the following:

1. What are the performance of the students in terms of:
   1.1. Organization of the projects;
   1.2. Subject knowledge of the projects;
   1.3. Graphics presentation of the projects;
   1.4. Mechanics in presenting the projects; and,
   1.5. Communication skills?
2. How effective is the PBL based on the performance in the oral presentation of the students?
3. Is there a significant difference between the pretest and posttest of the students?

Methodology

This study applied experimental design specifically using one-group pretest-posttest design. A single group is measured or observed not only after being exposed to a treatment of some sort, but also before. This implies that, only one group was studied and there was no control group.

The results of the pretest and posttest were subjected to statistical treatment to determine if there is significant difference on the focus group. A two-tailed t-test was used as a statistical tool at 0.05 level of significance.

Participants

The respondents of this study were the Grade Eleven students of President Quirino National High School of the school year 2019-2020 enrolled in STEM strand using complete enumeration method. There were 30 students considering the unequal number of male and female respondents from Grade Eleven - Tourmaline (STEM strand) and these respondents were chosen without regard of their mathematics grade. This students were used wherein the students were exposed to the Project-Based Learning Approach.

Instruments of the Study

The set of thirty-item (30) questionnaire was used for the conduct of pretest and posttest. The questionnaire was made by the researchers and validated by experts to ascertain that all items are consistent with the objectives of the study. And, the students' performance rubric was used to assess the student's presentation of their outputs. This is consisted of five categories. These are the organization of the projects, subject knowledge of the projects, graphic presentation of the projects, mechanics in presenting of projects and communication skills with the range from "outstanding" to "poor".

Procedure

The researcher set-up a meeting with the students, since one of researchers of this study was the pre-calculus teacher, for the teaching process which introduces to the students the Project-Based Learning Approach. The respondents were used seven (7) days of learning.

First day of the class, administering the pretest to the respondents of this study. Second day, the students were divided into four groups randomly. Each group selects their topic by means of draw lots. On the third day, the group went to library and make research about their topic and on the fourth day the groups went at computer laboratory to continue in researching their topic. Each group organized all the data gathered on the fifth day. They prepared the data gathered sequentially on the *metacards* or in the power point presentation. On the sixth day, each group was given eight (8) minutes for the oral presentation of the gathered information of the topics. And, posttest was administered on the last day. For the oral presentation, the teacher was assisted by other researcher and two (2) Mathematics teachers in assessing the students' oral presentation. After that, data were recoded, tabulated and statistically computed and analysed.

Results and Discussion

This part presents the data obtained from the results of the modified performance of the projects. These include the organization of the projects, subject

knowledge of the projects, graphics presentation of the projects, mechanics in presenting of the projects, and communication skills.

Organization of the Project

Table 1 shows that Group I (4.00), II (3.80) and IV (3.60) students have very satisfactory performances in terms of organization of the project. This implies that the students present information in logical sequence that the audience can follow. While the Group II with the mean of 2.40 has fair performance, this is due to difficulty in following presentation because students did not consistently use a logical sequence.

Table 1. *The Organization of the Project per Group*

Group	*Total*	*Mean*	*Description*
I	20	4.00	Very Satisfactory
II	12	2.40	Fair
III	19	3.80	Very Satisfactory
IV	18	3.60	Very Satisfactory
Grand Mean		3.45	Satisfactory

The grand mean of 3.45 indicates that the students satisfactory presented information in a logical sequence and therefore the learners followed the lesson.

Subject Knowledge of the Project

The Table 2 shows that Group I (3.60), and III (3.20) students have very satisfactory and satisfactory performance rating respectively in terms of subject knowledge of the project. These implied that the students can demonstrate knowledge in providing expected answers to questions but fail to elaborate more the answers. Group III (2.20) and IV (2.60) have fair performances. This means that students were uncomfortable with information and were able to answer only rudimentary questions.

Table 2. *The Subject Knowledge of the Project per Group*

Group	*Total*	*Mean*	*Description*
I	18	3.60	Very Satisfactory
II	16	3.20	Satisfactory
II	11	2.20	Fair
IV	10	2.60	Fair
Grand Mean		2.90	Satisfactory

The grand mean of 2.90 manifested satisfactory knowledge of the subject matter. To elaborate, students can demonstrate knowledge in providing expected answers to questions but fail to elaborate more the answers.

Graphics Presentation of the Project

Table 3. *The Graphics Presentation of the Project per Group*

Group	*Total*	*Mean*	*Description*
I	17	3.40	Satisfactory
II	16	3.20	Satisfactory
III	15	3.00	Satisfactory
IV	15	3.00	Satisfactory
Grand Mean		3.15	Satisfactory

Generally, students have satisfactory performance rating in terms of graphics presentation of the project with the grand mean of 3.15. This reveals that students' graphics relate to text and presentation.

Mechanics in Presenting of the Project

The data in Table 4 reflects that Group I, III, IV have outstanding performances. This implies that students present the information with no misspelling or grammatical error. Moreover, Group II obtained very satisfactory performance with mean of 3.80. This means that the presentation of the subject has more than two misspelling or grammatical error.

Table 4.*The Mechanics in Presenting of the Project per Group*

Group	*Total*	*Mean*	*Description*
I	23	4.60	Outstanding
II	19	3.80	Very Satisfactory
III	24	4.80	Outstanding
IV	24	4.80	Outstanding
Grand Mean		4.50	Outstanding

The results revealed that the students perform outstanding in the mechanics in presenting of the project. This implies that they present information with correct spelling and grammar as shown by its grand mean of 4.50.

Communication Skills

Table 5 shows Group I, III and IV have very satisfactory performance in communication skills. This implies that students were able to adjust vocabulary to suit the audience and facilitate understanding. On the

other hand, Group II obtained satisfactory performance rating, they made few errors that are not serious enough to impede understanding.

Table 5. *The Communication Skills per Group*

Group	*Total*	*Mean*	*Description*
I	18	3.60	Very Satisfactory
II	17	3.40	Satisfactory
III	20	4.00	Very Satisfactory
IV	19	3.80	Very Satisfactory
Grand Mean		3.70	Very Satisfactory

Generally, the grand mean of 3.70 indicates that the students very satisfactory show their skills in communication. This revealed that majority of the students adjust vocabulary to suit the audience and facilitate learning.

Performance of the Students in Project-based Learning

As shown in table 6 have satisfactory performance in organization of the project, subject knowledge of the project as well as in the graphics presentation of the project. This is manifested in their mean of 3.45, 2.90 and 3.20 respectively. Moreover, in mechanics in presenting of the project have an outstanding performance. This is manifested in the mean of 4.50. Furthermore, students have very satisfactory performance in communication skills.

Table 6. *The Performance of the Students in Project-based Learning*

Group	*Performance Rating*	*Description*
Organization of the Project	3.45	Satisfactory
Subject Knowledge of the Project	2.90	Satisfactory
Graphics Presentation of the Project	3.20	Satisfactory
Mechanics in Presenting of the Project	4.50	Outstanding
Communication Skills	3.70	Very Satisfactory
Grand Mean	3.55	Very Satisfactory

The computed over-all mean of 3.55 indicates that students have very satisfactory performance in terms of Project-based Learning. This implies that the Project-based Learning approach is really effective and helpful in learning pre-calculus.

The t-test of Difference of the Pretest and Posttest of the Focus Group

The computed t-value of 6.043 is greater than the critical value of 2.011 (two-tailed) at 0.05 level of significance. This tells that there is a significant difference on the pretest and posttest results of the focus group.

Table 7. *The t-test of Difference of the Pretest and Posttest of the Focus Group*

Group	*Mean*	*SD*	*t-value*	*Critical Value (two-tailed)*	*Remark*
Pretest	11	3.16	6.043	2.011	significant
Posttest	16.16	2.87			

This further implies that the project-based learning approach as an intervention in teaching conic sections (circle, parabola, hyperbola, and ellipse) was effective as shown in the strategic increase of the results in the posttest of the focus group.

Conclusion

Based on the summary of the findings, the pretest and posttest result of the focus group has significant difference in which the hypothesis is rejected. This implies that the use of Project-based Learning approach in learning conic sections (circle, parabola, hyperbola, and ellipse) among the Grade Eleven students of President Quirino National High School is effective.

References

Bentillo, E. et al. (2018). Supervision of Science and Mathematics Teaching. National Institute for Science and Mathematics Education Development (NISMED). Diliman, Quezon City.

George Lucas Educational Foundation. (2001, November 1). Project-based Learning Research. Edutopia.

Heong, T (2013). Problem Solving Abilities and Strategies in Solving Multistep Mathematical Problems Among Students. Kertas Projek Sarjana. Universiti Malaya.

Larmer, J., et.al (2016). 8 Essentials for Project-based Learning . Novato, CA: Buck Institute for Education

Salandanan, G., et,al (2012). Teaching Approaches and Strategies. Katha Publishing Co., Inc. 388, Quezon City 113.

Stenadall, R. (2015). Use your Six Intellectual Factors to Achieve Anything in Your Life. Article-idea.

Uyangor, S (2012). The Effects of project-based Learning on Teaching Polygon and Plane Geometry Unit. New Educational Review. 29(3), 212-223.

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