



**THE EFFECTIVENESS OF GEORGE POLYA METHOD IN TEACHING
MATHEMATICS AMONG GRADE 9 LEARNERS**

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ABSTRACT

Mathematics is essential to enhance the learners' cognitive ability promoting their academic performance. This study pursued to see the effect in the academic achievement test score result of Pre-test and Post-test after being exposed to George Polya's 4-step Method on Grade 9 students of Bugo National High School Year 2022-2023. A Quasi-experimental such as percentage, mean, and standard variation were used to determine and compare the results on the three major topics of the 4th Quarter Trigonometry, and Analysis of Covariance (ANCOVA) was used to determine the significant effect of the Experimental Group from the Conventional Group.

The results revealed that Based on the 4th Quarter Trigonometry, the Control Group had a 41% increase from the Pre-test and Post-test, while the Experimental Group had a 65% increase. Using the Analysis of Covariance, the p-value 0.036 is tested at a 0.05 level of significance, which resulted in rejecting the null hypothesis. George Polya's 4-step Method had a significant effect on the 4th Quarter Trigonometry of the students of Grade 9 Bugo National High

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School, School Year 2022-2023. Mathematics teachers must explore more variations of techniques and ways to help learners improve their problem-solving ability as it enhances their capability of thinking and affect significantly in their academic performance. George Polya is one of the proven methods that can be used.

Keywords: *George Poya 4-step Method, Achievement test, Academic Performance*

INTRODUCTION

The K to 12 Curriculum has been the basic education curriculum of the Philippines from School Year 2011 to 2012. DepEd former Secretary Bro. Armin Luis Luistro stated that change in perspective makes education truly relevant to the learners by using materials and techniques applicable to the learners' daily lives. In particular, critical thinking and problem-solving are now regarded as the twin goals of Mathematics teaching.

The Bugo National High School, School Year 2022-2023 learners are the first batch to attend face-to-face after blended learning, in which brewing issues of reading and numeracy were centered on the learners. In accordance with this, problem-solving in Mathematics is essential to enhance the learners' cognitive ability, hence promoting their academic performance. The school should provide various and strict strategies for hammering the learners' problem-solving skills.

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Relevant to the Mathematics goal of the curriculum, Fortes (2019) claimed that the curriculum encourages solving problems to provide independence by empowering learners to engage in higher-order thinking; teachers should support an interactive environment by allowing the students to develop a habit of the mind that leads to meaningful experience. Roble (2021) stated that one of the reasons is that Filipino children can compete on international standards. However, the country's recent results speak otherwise. TIMMS of 2019 Philippines ranked last in Mathematics among 58 countries, and PISA of 2018 Philippines ranked last among 79 participating countries.

George Polya (1957) published a book, "How To Solve It," which quickly became his most prized publication. It sold over one million copies and has been translated into 17 languages. In this book, he identifies four basic principles of problem-solving. The steps are to understand the problem, devise a plan, carry out the plan, and re-examine the solution.

According to Roble (2021), in relation to the teaching and learning of mathematical concepts, students need to possess creative thinking and problem-solving skills. As such, Mathematics educators must also design activities that promote creativity among students. Problem-solving methods are believed to be an indispensable part of educating students in Mathematics.

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According to the study of Yapatang et al. (2022), problem-solving requires students to solve problems in the classroom during a discussion, which proved to be an effective method in enhancing students' achievement in Mathematics. The present study employed George Polya's four-step problem-solving approach because students were given a new way of solving problems, which this current study theorized would help to develop students' mathematical achievements.

With these views mentioned above, the study focused on Grade 9 students of Bugo National High School during the School Year 2022 – 2023. The classes of Grade 9 are composed of six heterogenous sections with an average age of 15 years of age. The data privacy shall be strictly implemented with the parents' consent and their voluntary agreement to experiment with the students and see if there is a significant effect on their achievement test.

Research Instrument

The researcher used a 50-item standardized, unified multiple-choice test from the Department of Education last School Year 2021-2022 as the basis of Pre-test and Post-test. The exam consisted of the topics Trigonometric Ratios, Angle of Elevation and Depression, and Oblique Triangles. It was also the 4th quarter test based on the Most Essential Learning Competencies (MELC).

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Data Gathering Procedures

The researcher gave the two sections the Pre-test on May 02, 2023, which served as the basis of the difference after the intervention was given. One section is the Control Method of teaching; the other section was integrated with the Polya’s Method of problem-solving. The Post-test was given on July 03, 2023, as the basis of the effect of George Polya’s Method on the Experimental Group. The intervention was given up to nine weeks or a quarter in the education curriculum in the Philippines.

Ethical Consideration prior to the implementation of the data collection process, the researchers would seek the consent of parents, teachers and students to participate in the study, particularly during test administration. Likewise, the researchers ensured the safety of the participants during the test administration. The participants did not receive any honorarium from the researchers but they were informed of the results of the study after its conduct.

Statistical Treatment

Pre-test and Post-test scores were analyzed to determine the effectiveness of George Polya’s Method integrated into the lesson proper in the experimental class. The researcher used the mean of the scores in the three major topics: Trigonometric Ratios, Angles of Elevation and Depression, and Oblique Triangles. T-test was used to test the significant difference between the Post-test of the Control Group and Experimental Group and tested at 0.05 level of significance.

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Analysis of Covariance (ANCOVA) was tested at a 0.05 level of significance in determining the effectiveness of George Polya's 4-step Method.

Results and Discussions

Based on the gathered data, the findings were the following:

Control group and Experimental group did not have a wide difference in terms of the Pre-test since the assessment was given before the students learn about the topics.

Problem 1 The trigonometric ratios Pre-test performance of the respondents was measured for frequency, mean, and standard deviation. Given that the respondents had not yet encountered the topic, the Control Group's mean interpreted it as Fairly Satisfactory and described it as Developing. Similarly, the Experimental Group's mean score which was interpreted also as Fairly Satisfactory and described as Developing. On the Oblique Triangle Pre-Test Performance Frequency, Mean, and Standard Deviation of the Respondents, since the respondents had not yet encountered the topic, it is expected that the Control Group's mean score and its standard deviation would be interpreted as "Fairly Satisfactory" and described as "Developing." Similarly, the Experimental Group's mean score and standard deviation of would be described as "Developing" and interpreted as "Fairly Satisfactory". On the Angles of Elevation and Depression were also as expected given that the respondents had not yet encountered the topic. The Control group's mean score and its standard deviation indicate that the average scores are interpreted

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as "Fairly Satisfactory" and described as "Developing." Similarly, the Experimental group's mean score of and standard deviation indicated that the average scores are also interpreted as "Fairly Satisfactory" and described as "Developing." Even though the Experimental group's mean was lower than the Control Group's, both groups had the same description because the pre-test assessed respondents' knowledge of a particular mathematical topic from the Fourth quarter of Grade 9.

Problem 2 concerning the Trigonometric Ratios. The Control group's mean increased up to **56%**. While the mean of the Experimental group's mean increased up to **100%**. Based on the Angle of Elevation and Depression's domain. The mean the Control group's mean increased to **41%**. The mean of the Experimental group's mean increased up to **83%**. The mean of the Control group's mean increased to **32%**. The mean of the Experimental Group increased up to **34%**. This was from the Oblique Triangles.

Problem 3 the p-value of the Analysis of Covariance (ANCOVA) is 0.036 which is less than 0.05 level of significance. This indicated that George Polya's 4-step Method gives an impression of significant effect of the academic performance. Trigonometric ratio performance in the Pre-test: frequency, mean, and standard deviation of the respondents. As expected given that the respondents had not yet encountered the topic, the Control Group's mean score of 3 and its standard deviation of 1.8 indicate that the average scores are classified as "Fairly Satisfactory" and as "Developing." Similarly, the Experimental Group's mean score of 2.9 and its standard

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deviation of 1.5 indicate that the group's average scores are also classified as "Fairly Satisfactory" and as "Developing." The null hypothesis, which said that "there is no significant effect" in the Post-test results of the Experimental Group after being exposed to George Polya's Method of teaching Grade 9 Mathematics, was rejected, as indicated by the p-value of the Analysis of Covariance (ANCOVA), which was less than 0.05 level of significance. As a result, the George Polya 4-step approach to teaching Mathematics in Grade 9 was found to have a significant effect.

Conclusion

Based on the findings of the study, the following conclusions are drawn:

This study strongly approved that George Polya's Problem-Solving Method can affect significantly to the academic performance exam results, hence implying the outcome of Mathematics education. Students of Grade 9 of Bugo National High School solved problems requiring previously unknown concepts using George Polya's 4-step Method before consolidating and understanding the main idea. Failure was part of the process and defined as a student's inability to come up with or identify the appropriate solution(s) on their own. However, the Method can help students learn more effectively from the next lesson to the point where they can produce mediocre or even inaccurate answers to the problem.

One of the most important competencies for the twenty-first century is problem-solving ability, which is also essential for success in the modern, expanding global economy. Furthermore,

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since Mathematics requires problem-solving skills, creativity or the ability to think creatively is crucial.

Based on the results of the study, the Method of George Polya has sharpened the minds of the learners of the grade 9 of Bugo National High School as they use their thinking capacity especially in problem solving. Students exposed to the Method had increased significantly in their academic performance in the Angles of Elevation and Depression since the Method is fit on the problem solving thus, the topic was much more on application or real-life problems. George Polya's 4-step Method greatly affected the academic performance of the Grade 9 learners of Bugo National High School 2022-2023.

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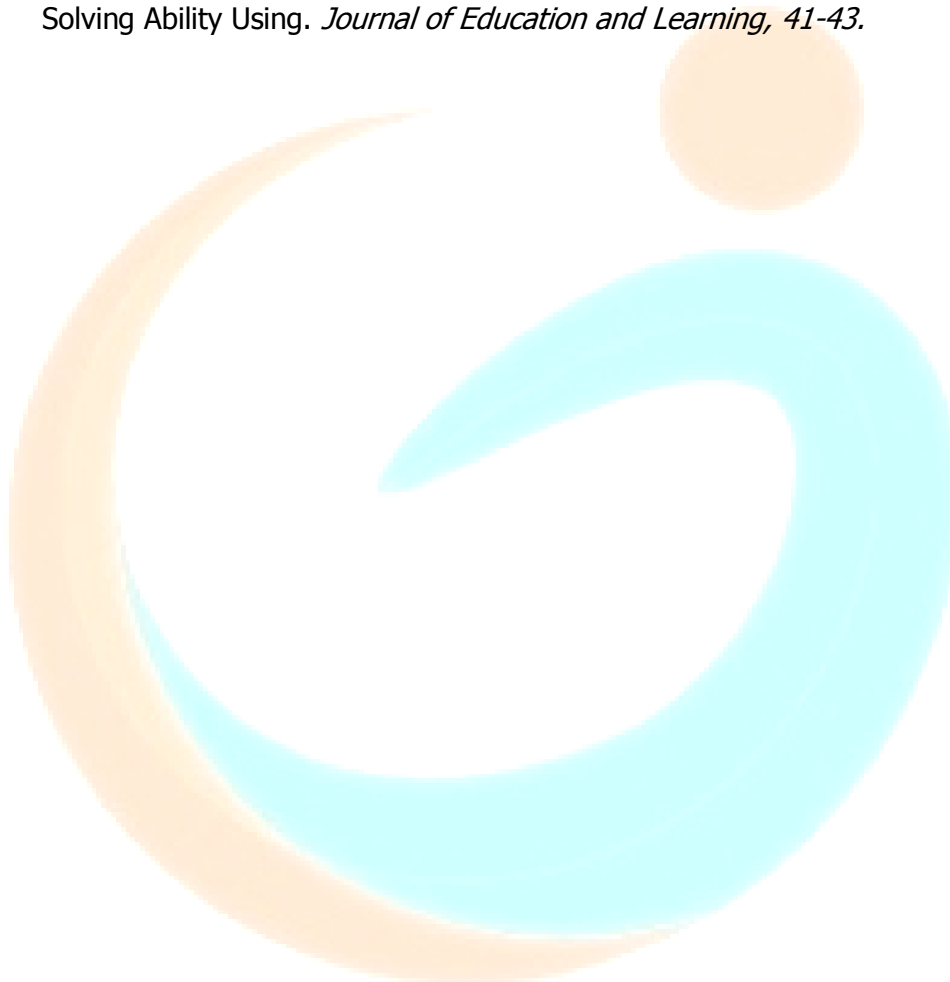
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