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Mathematical Software GeoGebra: Its Effect on Students' Competency in Mathematics

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Abstract

This study was conducted to examine the effect of the mathematical software GeoGebra on students' competency in Mathematics among Grade 10 students of a public high school in Aklan S.Y. 2022-2023. The quasi-experimental research design was employed in this study. The participants of the study were randomly selected 40 students who were match-paired based on their first quarter academic performance in Mathematics. Twenty students were assigned to the control group and twenty students to the experimental group. GeoGebra software was utilized in the experimental group while the control group was taught using the conventional method of teaching Mathematics. The findings showed that both the control group and experimental group had the same level of prior knowledge before the intervention. After the intervention, post-test results showed that both groups had increased their level of learning. Nevertheless, the post-test mean scores revealed that there was a significant difference, wherein the experimental group scored higher than the control group. Hence, GeoGebra software increased the students' mathematical competency compared to the conventional method of teaching mathematics.

Keywords: *Mathematical software, GeoGebra, quasi-experimental, students' competency, Mathematics*

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Introduction

The main purpose of this study was to find out if the mathematical software GeoGebra can remediate the gap in the teaching and learning of Mathematics. Mathematics is an indispensable subject of the Department of Education (DepEd) K-12 curriculum in the Philippines which necessitates the used of critical thinking skills and perceived as important in daily living as well as in the development of other sciences. (Artuz & Roble, 2021). Problems related to mathematics achievement are still evident in the Philippines. The participation of the Philippines in Trend International Mathematical Science Study Advanced (TIMSS) 2019 confirmed that only 19% of Filipino students were on Low benchmark, which means they had "some basic mathematical knowledge" and 81% did not reach this level (Mulis, Martin, Foy, Kelly, & Fishbien, 2020). In relation to this, perennial problems have become a concern for teachers in Union National High School, raised in one of the School Learning Action Cell (SLAC) regularly conducted by the school's mathematics department. According to the Quarterly Summative Assessment Result, the average Academic Performance of Grade 10 students in Mathematics is at Satisfactory Level based on DepEd Order No. 8 s. 2015.

Students may become disinterested in Mathematics because they need help to create the necessary geometrical constructions. The insufficient resources of a pencil and paper medium causes students to construct a limited concept. The National Council of Teachers of Mathematics highlighted that technology integration in the teaching and learning Mathematics is necessity. The NCTM also declares that students who use technology learn more Mathematics in-depth (Kumah & Wonu, 2020). Thus, GeoGebra was introduced to fill this gap by allowing students to visualize and understand Mathematics.

GeoGebra is used in many ways in the teaching and learning of mathematics such as; displaying and visualization, since it's provide different representations as a construction tool since it has the abilities for constructing shapes and helps in preparing teaching materials. Rajagopal, Ismail, Ali & Sulaiman (2015) claimed that students found GeoGebra as a helpful tool for them to learn Mathematics. Hence, this study investigated whether this learning method using GeoGebra Software will surpass the conventional method in teaching and learning of Mathematics.

Methodology

This study employed a quasi-experimental research design. The Matching-Only Pre-test-Post-test Control Group Design adopted from Fraenkel and Wallen (2012) that is found to be the

most relevant research design to this study because it enables the researcher to investigate the effect of using GeoGebra software on students' competency in Mathematics. Quasi-experimental research design examines whether there is a causal relationship between independent and dependent variables.

The simple random sampling technique was used in the study. The participants for this study were randomly selected forty (40) out 190 Grade 10 students of Union National High School who are currently enrolled in the school year 2022 – 2023. This study was conducted from October 3, 2022 to November 25, 2022. Due to the strict health protocol, each group was composed of twenty students as mandated in the DepEd Memorandum No. 71, s. 2021. The forty (40) students were divided and distributed equally into two groups. Twenty participants (20) of the sample were selected for the control group and twenty participants (20) of the sample assigned for the experimental group. The researcher selected and matched them based on their First Quarter Academic Performance in Mathematics.

A diagnostic pre-test and post-test instrument that used in the study is the researcher-made test validated by three Mathematics teachers of Union National High School. This researcher-made test is multiple choice questions composed of fifteen (15) items and a Table of Specifications was made to ensure its content validity. This test was administered first to the Grade 10 students who are non-participants in this study to measure its reliability. The researcher used mean score in order to find out what level of the most participants in both experimental group and control group. The researcher used Wilcoxon Signed Rank Test to determine if there is significant difference between the pre-test and post-test results of both experimental and control groups. Also, Mann-Whitney U test was used to determine if there is significant difference between the pre-test result of the control group and the experimental group, and the post-test result of the experimental group and control group. All statistical analysis was set to 0.05 significance level.

The p-value must be less than the significance level of 0.05 to reject the null hypothesis. However, accept the null hypothesis if the p-value is greater than the significance level of 0.05. These inferential statistics was treated and analyzed using SPSS version 27 statistical software system.

Findings

When pre-test results of two groups were being compared, the conventional method and using GeoGebra software, both gives a very low level of competency in mathematics. Thus, makes no significant difference. Because of that, the researcher could conclude that the students'

competency level was almost the same on the topics even before the treatment had been implemented. When Conventional Method is being implemented to the participants of control group, pre-test and post-test results showed that there is a significant difference since there was an increase in the student's score. Hence, even the traditional way of teaching could still help in increasing the student's competency in Mathematics. When the GeoGebra software was being applied, pre-test and post-test results revealed that there is a significant difference since there is an improvement in the student's score. Consequently, the utilization GeoGebra software in the process of learning mathematics proved to be effective. When post-test results of two groups were being compared, control group exhibited high level of competency while experimental group displayed very high level of competency. Nevertheless, the test of significance proved that there was significant difference between the two groups. Therefore, the utilization of GeoGebra software is better than the traditional method.

Conclusion

The researcher concluded that students were learned more using the GeoGebra software in the teaching and learning mathematics. In this strategy, students were given a chance to work independently as they will draw and graph shapes on the screen of tablet. Plus, GeoGebra software equipped with attractive animations and images that can boost the students' interest, enjoyment, and satisfaction. With this, students were learning cheerfully. Hence, students who exposed to GeoGebra exhibited better remembering of concepts and have better improvement of competency in mathematics. Mathematical learning will be more meaningful with the combination of teacher creativity and modern technology. By integrating both approaches, the educational level can be improved, the learning process should be more vivid, and increase students' enthusiasm together with problem-solving and critical thinking skills. In other words, students will no longer bound by either one teaching method; they can enjoy the convenience that the new teaching approach brings them and perceive the advantages of technology-based learning. As a result, mathematics teaching and learning will become more holistic.

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