

# Using Graphing Application in Illustrating the Conic Sections: Its Effect on Student's Performance

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## Abstract

Nowadays, there are lots of Mathematics software and applications that learners can use for their learning, especially on graphing and one of those is GeoGebra. The main objective of this study was to determine the effects of graphing applications in illustrating the conic sections on student performance. A quantitative design specifically the correlational method was used to consider the extent to which differences between variables are related to the differences in other variables and to determine the relationship between student's perception and performance in illustrating conic sections using graphing application. The respondents of this study were the Grade 11 Science, Technology, Engineering, and Mathematics students of Araceli National High School consisting of 17 students. The findings showed a weak positive correlation between the student's perception and performance in illustrating conic sections using a graphing application and a significant difference in the student's performance in illustrating conic sections before and after using the application. The research findings suggested that all mathematics teachers should incorporate the use of graphing application – GeoGebra because it is highly beneficial and applicable in teaching topics involving graphing. Hence, future researchers should explore other graphing applications that could be used in teaching the conic sections.

**Keywords—** Graphing Application – GeoGebra, Conic Sections, Level of Performance, Perception

## I. INTRODUCTION

Learning especially during this time of pandemic is very crucial. Nowadays, 21st century learners are familiar on different phone applications and computer software that can be used either for leisure or for educational purposes. There are lots of Mathematics software and applications that learners can use for their learning, especially in graphing. One of those is GeoGebra which is based on my experience in using it and is useful specifically for graphing equations related to Geometry, Calculus, Trigonometry, Algebra, etc.

GeoGebra is dynamic mathematics software for all levels of education that brings together geometry, algebra, spreadsheets, graphing, statistics, and calculus in one easy-to-use package. GeoGebra is a rapidly expanding community of millions of users located in just about every country. GeoGebra has become the leading provider of dynamic mathematics software, supporting science, technology, engineering, and mathematics (STEM) education and innovations in teaching and learning worldwide (Katarzyna Winkowska-Nowak). In this study, we will be going to find out and determine the effects of

using graphing application – GeoGebra on student's performance.

Learners taking up Science, Technology, Engineering, and Mathematics (STEM) track have specialized Mathematics subject – Pre-calculus wherein they study the conic sections e.g. circle, parabola, hyperbola, and ellipse. In the past school years, teachers are using pen and paper, chalk and board and mathematical tools in illustrating the conic sections. Since, graphing applications are available for phones and personal computers it's a great opportunity to learn, explore, and maximize its usage.

Kabubu N. C. (2019) found out that 65% of the students stated that after the use of GeoGebra software, they could solve more problems in geometry compared to other times when they did not apply GeoGebra software, hence the application of GeoGebra software helps stimulate the students' knowledge. The study recommends the use of GeoGebra software to improve students' motivation, attitude, and achievement in Euclidean geometry. With regards to this, this study will find out if the graphing application will be of great help to the

Science, Technology, Engineering and Mathematics (STEM) 11 students of Araceli National High School.

The use of GeoGebra in learning geometric transformations increased overall student motivation, engagement, and achievement. Students became more interested in their learning with the use of the software because it provided a dynamic, hands-on, and discovery learning environment (Vasquez D.E. 2015). In the study of Tubona G. and Ibibo C.O.G (2019), the result revealed that students of all ability levels benefitted from the use of GeoGebra software in the teaching and learning of circle geometry. It was also concluded that the use of GeoGebra software to teach circle geometry improved students' performance of all ability levels and students have a positive perception of the use of GeoGebra software. Adeleke et.al (2016) study concluded that the attitude of students towards the use of GeoGebra instructional package depend on their perceptions on its usefulness and its ease of use.

This study will also find out the perceptions of students in using the graphing application. Previous studies indicate that GeoGebra improves the discovery learning process (Mainali & Key, 2012) and also students' motivation, engagement, and achievement in mathematics learning (Dogan & İçel, 2011). Several studies have reported positive attitudes of students and mathematics teachers toward using this software in mathematics teaching and learning (Saha, Ayub, & Tarmizi, 2010; Shadaan & Eu, 2013; Zakaria & Lee, 2012). However, the use of GeoGebra has also limitations. According to Wassie Y.A. and Zergaw G. A. (2019), The difficulty of some commands in the input bar especially for students and teachers with no prior programming experience is considered among the limitations of GeoGebra. It is necessary to orient the students first before they use the said application so that it will not be that difficult for them to use and explore the graphing application.

Generally, the main objective of this study was to determine the effects of using graphing applications in illustrating the conic sections on student's performance. Furthermore, the study also aimed to investigate if the use of graphing applications in teaching surpassed the traditional method and if students perceived learning using graphing applications as helpful and useful.

### Statement of the Problem

Thus, this study sought to answer the following research questions:

1. What is the level of performance of students in illustrating the conic sections using graphing applications?

2. What is the student's perception about using graphing application in illustrating the conic sections?
3. Is there a significant relationship between the student's perception and performance in illustrating conic sections using graphing application?
4. Is there a significant difference on the student's performance in illustrating conic sections before and after using a graphing application?

### Research Hypotheses

1. There is a significant relationship between the student's perception and level of performance in illustrating conic sections using graphing application.
2. There is a significant difference on the student's performance in illustrating conic sections with or without using a graphing application.

## II. METHODS

### Research Design

This study used quantitative design specifically the correlational method to consider the extent to which differences between variables are related to the differences in another variable. Also, quantitative and qualitative design was used to quantify and describe the data that will be gathered. The correlational method was also used to determine the relationship between student's perception and level of performance in illustrating conic sections using a graphing application.

### Population

The respondents of this study were the Grade 11 Science, Technology, Engineering, and Mathematics students of Araceli National High School. The researcher used the population as respondents since they are only one (1) section and consist of 17 students.

### Research Instrument

The researcher used a fifteen (15) items Likert-scale survey questionnaire to elicit the perceptions of students in the use of graphing applications in illustrating the conic sections. Students were given a pre-test and a post-test about the illustration of the conic sections before and after using the graphing application.

### Research Procedure

The researcher asked permission through a letter from the school head to be allowed in conducting the said study and to gather the information needed to find out the effects of graphing application on student's performance. There was an informed consent that was given to the students and also to parents since some of them are still minors. and the researcher makes sure to follow ethical standards in

conducting the study. The pre-test without using the graphing application was conducted on August 17 in the morning while the pre-test with the use of the graphing application was conducted on August 17 in the afternoon. On August 18 – 24, there comes the discussion and exercises about the conic sections. There was also a drill on the use of the graphing application and the researcher let them try to graph two of the four conics so that they will know how the application runs. On August 25. They were given the post-test, in the morning without the use of the graphing application, and in the afternoon, they were allowed to use the graphing application. Then after the post-test, they are given a 15-item survey questionnaire about their perception of the use of the graphing application in illustrating the conic section.

**Statistical Treatment**

The researcher used Microsoft Office Excel – Mega Stat to get the frequencies and percentage to find the level of performance of the student; to get the mean and standard deviation in finding the level of perceptions of students; and one-sample t-test was used to find the difference on the student’s performance in illustrating conic sections with or without using a graphing application. Moreover, the researcher also used IBM SPSS Statistics Software specifically the Pearson-R to determine and measure the strength of relationship between two variables.

**III. RESULTS**

*Table 1. Performance of Students in Illustrating the Conic Sections Using Graphing Application*

Performance in Illustrating the Conic Section Using Graphing Application	Frequency	Percentage
90-100	7	41%
85-89	1	6%
80-84	2	12%
75-79	7	41%
below 75	0	0%
Total	17	100%

*Table 2. The indicator of the level of performance*

Level of Performance	
Descriptors/Remarks	Grading Scale
Outstanding	90 - 100
Very Satisfactory	85 - 89
Satisfactory	80 - 84
Fairly Satisfactory	75 - 79
Did Not Meet the Expectation	Below 75

Table 1 shows the level of performance of students in illustrating the conic sections using graphing application. Out of 17 students, seven (7) or forty-one percent (41%) were outstanding, one (1) or six percent (6%) was very satisfactory, two (2) or twelve percent (12%) were satisfactory and seven (7) or forty-one percent (41%) was fairly satisfactory in the test regarding the

illustration of the conic sections using graphing application. (The descriptors for the level of performance can be seen in Table 2). Based on the findings, it can be implied that students find it easier to illustrate the conic sections when using the graphing application since all of them passed the given test.

Table 3. Student’s Perception About Using Graphing Application in Illustrating the Conic Sections

Statement	Mean	SD	Remarks
1. I like to use graphing application - GeoGebra	3.00	0.00	Very Positive
2. Graphing application - GeoGebra help me to learn easily about the graphing of the conic sections.	3.29	0.46	Very Positive
3. I feel confident when illustrating conics using the graphing application GeoGebra.	3.00	0.00	Very Positive
4. I can think critically when using graphing application - GeoGebra	2.88	0.47	Positive
5. I learn faster when using graphing application – GeoGebra.	2.88	0.47	Positive
6. I prefer to learn illustrating the conic section with graphing application – GeoGebra.	4.00	0.00	Very Positive
7. I am excited to use graphing application when asked to explore the conic sections.	3.29	0.46	Very Positive
8. Graphing application - GeoGebra helps to increase my performance in Pre-Calculus subject.	3.12	0.68	Very Positive
9. I am happy when the teaching of pre-calculus involves the use of graphing application – GeoGebra.	4.00	0.00	Very Positive
10. I was engaged in the learning process using graphing application – GeoGebra	4.00	0.00	Very Positive
11. Graphing application - GeoGebra allows me learn content in playful and motivating way.	3.00	0.00	Very Positive
12. GeoGebra allows me to visualize and manipulate the conic sections.	3.18	0.62	Very Positive
13. I was able to think creatively and critically in the discussions and during the question and answer session.	2.82	0.62	Positive
14. I enjoyed learning about the conic sections much more – using the graphing application – GeoGebra.	4.00	0.00	Very Positive
15. I was able to form better connections between previous learning and new learning	4.00	0.00	Very Positive
<b>Overall Mean</b>	<b>3.36</b>		<b>Very Positive</b>

Table 4. The qualitative descriptions of student’s performance

Level of Perception	
Descriptors/Remarks	Grading Scale
Very positive	3.00-4.00
Positive	2.00-2.99
Negative	1.00-1.99
Very Negative	0.00-0.99

Table 3 shows the student’s perception of using graphing application in Illustrating the Conic Section. The student’s perception was identified through a set of questionnaire consists of fifteen (15) items. The questionnaire was distributed to the participants only to know their perception on the use of graphing application in illustrating the conic sections.

The study found that the items in the questionnaire that had the lowest mean were the item that stated that students were able to think creatively and critically in the discussions and during the question and answer session with a mean of 2.82 while the highest mean was 4, which is obtained from that statements saying they preferred to learn illustrating the conic section with graphing application – GeoGebra, they are happy when the

teaching of pre-calculus involves the use of graphing application – GeoGebra, they engaged themselves in the learning process using graphing application – GeoGebra, they enjoyed learning about the conic sections much more – using the graphing application – GeoGebra and they were able to form better connections between previous learning and new learning. Hence, the mean of 2.82 indicates a positive perception while the mean of 4 indicates a very positive perceptions on the use of graphing application.

In addition, the overall mean is 3.36. This tells us that all the students have positive feedbacks with the statements regarding the use of graphing application. Additionally, we can probably say that the use of graphing application has positive effect on the students. Also, it can

be concluded that using graphing application can increase student’s interest, creativity, motivation and confidence in illustrating the conic sections.

Table 5. Relationship Between the Student’s Perception and Performance in Illustrating Conic Sections Using Graphing Application

	mean	r	p-value
Student’s Perception	3.36	0.376	0.137
Performance in Illustrating Conic Sections	87		

Table 5 shows the strength of relationship of the student’s perception and performance in illustrating conic sections using graphing application. The strength of relationship between the two variables is 0.250 meaning there is a weak positive correlation between the student’s perception and their level of performance. This implies that the more the student’s use graphing application, the better their performance would be.

On the other hand, since the p-value of 0.137 is greater than the significance level of 0.05 then we say that there is no significant relationship between the student’s perceptions and their performance in illustrating conic sections using graphing applications. Though there is a positive correlation with the two variables, there is not enough evidence to prove that their relationship exists. Regardless of the student’s perception, their performance in the conic sections may get high or low.

Table 6. Student’s Performance in Illustrating Conic Sections with Or Without Using A Graphing Application

Student’s Performance	mean	t	p-value
Using Graphing Application	43.35	5.76	2.15556E <sup>^-06</sup>
Without Using Graphing Application	29.47		
<b>Mean Difference</b>	13.88		

Table 6 shows the difference on the student’s performance in illustrating conic sections before and after using a graphing application. With respect to the mean, there is a 13.88 difference on the performance of the students in illustrating the conic sections. In relation to the findings, student’s performance significantly improves when using the graphing application in illustrating the conic sections.

The t-value of 5.76 indicates that there is strong evidence to prove that there is a significant difference on the student’s performance before and after using the graphing application. In addition, the p-value is 2.15556E-06 which is less than the alpha level 0.05 indicates that the variables involved are significantly different with each other. Therefore, the null hypothesis was rejected and the alternative hypothesis was accepted. Hence, we can say that there is enough evidence to prove that there is a significant difference on the student’s performance in illustrating conic sections before and after using a graphing application.

#### IV. DISCUSSION

The purpose of this study was to determine the effects of using GeoGebra on student’s performance in illustrating the conic sections on student’s performance. Furthermore, the study also aimed to investigate if the use of GeoGebra in teaching surpassed the traditional method and if students perceived learning using graphing application is helpful and useful.

Based on the findings, student’s level of performance only falls on Outstanding, Very Satisfactory, Satisfactory and Fairly Satisfactory. Through this, it can be implied that students find it easier to illustrate the conic sections when using the graphing application. It was also found out that graphing applications was an effective tool in the learning of the conic sections.

The study also found out that all the Grade 11 Science, Technology, Engineering and Mathematics (STEM) students preferred to learn illustrating the conic section with graphing application, they were happy when the teaching of pre-calculus involves the use of graphing application, they engaged themselves in the learning process using graphing application, they enjoyed learning about the conic sections much more – using the graphing application and they were able to form better connections between previous learning and new learning. With the overall mean is 3.36, we can probably say that using graphing application can increase student’s interest, creativity, motivation and confidence in illustrating the conic sections.

The r of 0.250 indicated that there is a weak positive correlation between the student’s perception and their performance. This implies that the more the student’s use graphing application, the better their performance would be. However, since the p-value of 0.137 is greater than the significance level of 0.05 then we say that there is no significant relationship between the student’s perceptions and their performance in illustrating conic sections using graphing applications.

The mean difference of 13.88 on the performance of the students in illustrating the conic sections. Implies that student's performance significantly improves when using the graphing application. With the p-value is 2.15556E-06 which is less than the alpha level 0.05, we reject the null hypothesis and accept the alternative hypothesis. Thus, we say that there is a significant difference on the student's performance in illustrating conic sections with or without using a graphing application. Figures should be numbered in the order they appear in the text.

Table captions appear centered above the table in upper- and lower-case letters. When referring to a table in the text, no abbreviation is used and "Table" is capitalized.

## V. CONCLUSION

In conclusion, the level of performance of students in illustrating the conic sections using graphing applications are outstanding, very satisfactory, satisfactory and fairly satisfactory. The student's overall perception about using graphing application in illustrating the conic sections using graphing application is very positive. Hence, the student's perception can increase their interest, creativity, motivation and confidence in illustrating the conic sections. There is not enough evidence to prove the significant relationship between the student's perception and performance in illustrating conic sections using graphing application. Lastly, there is a significant difference on the student's performance in illustrating conic sections before and after using a graphing application.

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