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Improving Academic Performance in Geometry Using a Mastery Learning Approach through GeoGebra

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Abstract

The objectives of these quasi-experimental methods were to improve academic performance in geometry using a mastery learning approach through GeoGebra for mathematics teacher students and to investigate students' satisfaction with using a mastery learning approach through GeoGebra in geometry. The participants were divided into two groups, involving 30 and 29 students, respectively. The experimental group with 30 students received instruction in the mastery learning approach through GeoGebra, while the control group received a traditional education in learning geometry. At the end of the lessons, post-tests were administered to both groups. The statistical difference between the participant's post-test academic performance in the experimental and control groups was analyzed with an independent sample *t*-test after examining the assumptions of this test, namely normality and homogeneity in each group, while percentages and means were used to assess the satisfaction of the experimental group. The instruments used were the Geometry Achievement Test (GAT), which consists of 2D and 3D dimensions, and a questionnaire with satisfied students. Results of the study indicated that the scores of academic performances in the experimental group were significantly higher than those of the control group. Analysis of the questionnaire responses indicated a positive overall satisfaction with using a mastery learning approach through GeoGebra in geometry. On the other hand, instruction with a mastery learning approach through GeoGebra supported students' learning of these subjects meaningfully and conceptually.

Keywords: GeoGebra, Geometry, Mastery learning approach

1. Introduction

1.1 Introduce the Problem

Mathematics is one of the most important parts of how our minds have changed over time because it lets us be creative, and think rationally and methodically. Have a pattern, be able to look deeply and carefully at problems or situations, and help with forecasting and planning to determine and correctly solve problems and implement the solutions in everyday life. There are several reasons why a student's math grades are satisfactory. It's also not satisfying and especially hard in geometry because of how the teacher teaches (Adeniji et al., 2018). So, teachers should improve the way they teach so that students can understand and use geometry. This will make both teaching and learning more successful. Bloom (1976) says that learners will be able to understand difficult material in the end, but that cognitive learning helps some learners learn faster. Wong and Kang (2012) say that cognitive learning gives students access to what is being taught and gives feedback that always points out mistakes, suggests ways to improve, and shows improvement.

1.2 Explore the Importance of the Problem

One of the most important goals of learning to read and write is to help students find information for everyone. Taking into account that students have different strengths and weaknesses, a well-rounded approach to learning works for all students at the same level and at a higher topic level. Instructors who split information into units using well-rounded learning. Give each unit's learners competency and achievement tests until everyone has mastered the unit's material and can answer its challenges. Only then should they move on to the next unit. By giving students who haven't met the prerequisite standards yet tests at the same time, the problem is solved. New material is connected to previously gathered information (Daramola, 1994). This allows students to successfully answer issues in a new subject. Therefore, it indicates that studying geometry is better and more effective when a whole-person approach is employed. Additionally, there is a lot of math software designed to assist teachers in their instruction because of the development of technology in teaching and learning. One of them is the GeoGebra software, which Arbain and Shukor (2015) say could help teachers make good teaching materials.

The National Council of Teachers of Mathematics (NCTM) Principles and Standards for School Mathematics, which list technology as one of their six principles for school mathematics, are also an endeavor by the math teacher student in Thailand. According to NCTM (2000), technology is important in teaching mathematics because it influences the subject matter taught and improves student learning. In addition, technology can help students organize and analyze data, compute quickly and accurately, and provide them with visual representations of mathematical concepts. Students can use technology to support their study in all areas of mathematics, including geometry, statistics, algebra, measurement, and numbers (NCTM, 2000). If math teachers want their students to see and understand geometry better, they need to use technology in the classroom. Additionally, GeoGebra is an alternative tool that can be employed to teach geometry.

1.3 Describe Relevant Scholarship

Through the design of a mathematicians' alternative teaching and learning program, GeoGebra is a dynamic geometry software program that allows students to create geometric thought processes and reasoning. Hohenwarter and Fuchs (2004) say that putting geometry, algebra, graphs, statistics, and calculus into a single, easy-to-use tool is good for all levels of math education. In addition, the GeoGebra application is available to all users at no cost. In terms of geometry, the GeoGebra program can help students understand and visualize abstract ideas, deal with differences between people, learn on their own, and study as often as they want. It does this by providing a medium that interacts with students and can be used on any operating system (Dahal et al., 2019).

Thus, GeoGebra contributes to the enhancement of geometry knowledge and comprehension. GeoGebra software assisted students in enhancing their academic performance, and Nongharnpituk et al. (2022) found that the intervention increased students' interest and enjoyment. The intervention allowed students to show their creativity more freely and discover more about themselves. GeoGebra integration is a good and efficient method for teaching mathematics. After reviewing a variety of studies on the efficiency of GeoGebra in the teaching of mathematics, Uwurukundo et al. (2020) found that GeoGebra is effective in teaching and learning mathematics because it helped students better understand mathematical concepts and increased their interest in the subject. Various researchers (Kusumah et al., 2020; Uwurukundo et al., 2022) stated applying GeoGebra in geometry lessons aids students

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in content visualization and understanding through exploration, improving their attitude toward geometry and performance. The integration of GeoGebra has not been the subject of many studies to determine whether it may influence students' performance, even though similar studies have been performed and these problems observed. This motivates researchers to look into how well GeoGebra helps students understand geometry. Because of the teachers' traditional teaching techniques, children have exhibited a lack of interest in learning mathematics (Ukobizaba et al., 2021). Our findings would help teachers motivate students to study mathematics using GeoGebra.

Mastery learning enables students to realize their full potential by providing opportunities to develop a wide range of skills, such as communication, collaboration, problem-solving, critical thinking, perseverance, and creativity, as well as improving background knowledge and understanding in a wide range of subjects. Since employers and colleges place a high value on these skills and abilities, the expanded curriculum that is a key part of mastery learning may help students get ready for college and a career (Allen, 2011), which has been found in many research studies. Yemi (2018) investigated into how the Mastery Learning Approach (MLA) could improve students' academic performance in mathematics. According to studies by Zakariyya et al. (2016) and Adeniji et al. (2018), the mastery learning approach enhanced students' geometry performances. Kakraba (2020) looked into the effects of pre-service mathematics teachers' performance in the geometry topic using a mastery-based learning approach. The mastery learning approach is effective in improving geometry performance in math teachers to previous research. One strategy for mastering learning involves various approaches to mastery learning, each of which must consider five processes. The five-step master learning process is shown in Figure 1.

Figure 1. The five-step mastery learning process

Even though there are many different mastery learning systems, all of them must take into account the five processes listed above in some way. Each technique must take into account the differences between students by tailoring the lesson to their needs and skills. If it weren't for the fact that it would require a lot of human resources, having a good instructor for each student would be a perfect solution. Anyhow, the learning support relationship is a useful model to work with when trying to come up with a less expensive plan of action (Block & Burns, 1976).

1.4 State Hypotheses and Their Correspondence to Research Design

Because of how important it is and where the above problems come from, researchers looked into how to teach geometry in mastery learning through GeoGebra for math teachers. They did this to gain a better understanding of geometry content and to find out what happened when teachers taught, and students learned. The goals of this study are: (1) to improve students' academic performance using a mastery learning approach through GeoGebra; and (2) to investigate students' satisfaction with using a mastery learning approach through GeoGebra in geometry.

2. Method

2.1 Participants

During the first semester of the 2022 school year, there were 283 first-year math majors at one university in Thailand. The participants in the study were divided into two groups of undergraduate mathematics students. The researcher chose an experimental group and control groups for the study using a lottery or a simple random sampling method. The number of these students depends on the department's capabilities. There were 59 participants overall, divided into experimental and control groups. As seen in Table 1, the experimental group included 30 students, while the control group had 29 students. The researchers provided both groups with instructions as shown in Table 1.

Table 1. Composition of the samples

Number of Students	Group	n	Percentage (%)
59	Experimental	30	50.85
	Control	29	49.15

2.2 Research Instrument

2.2.1 Instruments

The instruments in this study were: 1) the Geometry Achievement Test (GAT), a test that included a word problem and multiple-choice questions that consisted of 2-D (consisting of a line, parallel line, triangle, rectangle, circle, and polygons) and 3-D (consisting of the cube, pyramid, cone, prism, cylinder, and sphere), for which the researcher presented examples of worksheets that can be seen in Figures 2-5, and 2) there was also a 15-item survey evaluating the students' satisfaction with management learning. Multiple-choice questions are no longer seen as a good technique to get a decent answer because they don't provide a clear enough picture of a student's knowledge and abilities (Whittington & Hunt, 1999), thus the test included both multiple-choice questions and a word problem (Sharma, 2021). The test consists of 12 questions and has a five-level scoring system: With a maximum score of 60 points, students receive a score of (5 = the student completes all-important task components and communicates ideas clearly; 4 = the student completes the most important task components and communicates ideas clearly; 3 = the student completes some important task components and communicates those clearly; 2 = the student demonstrates only a basic understanding; 1 = a blank or no response) (Kubiszyn & Borich, 2016). In this study, math teacher students in the experimental group were compared to those in the control group in geometry. By adding the results of the two types of tests, the researcher will be able to see if the math teacher's students knew anything about geometry before, during, and after the study. The Statistical Package for Social Sciences Version 28.0 (SPSS 28.0) software was used to analyze the data. The following section goes through each instrument's reliability and validity.

2.2.2 Validity of the Instrument

By Thompson (2013), validating a test involves a continuous process of evaluating the accuracy of assumptions generated from test results. The assessment, the mastery learning technique using the GeoGebra lesson plan, and the course outline were given to an expert in using GeoGebra in geometry and mathematics education (with a master's degree or Ph.D. in mathematics education) to check the validity of this study. Each instrument of research that has been created will be examined by experts to confirm that the research questions and any essential specification tables are correct and employed.

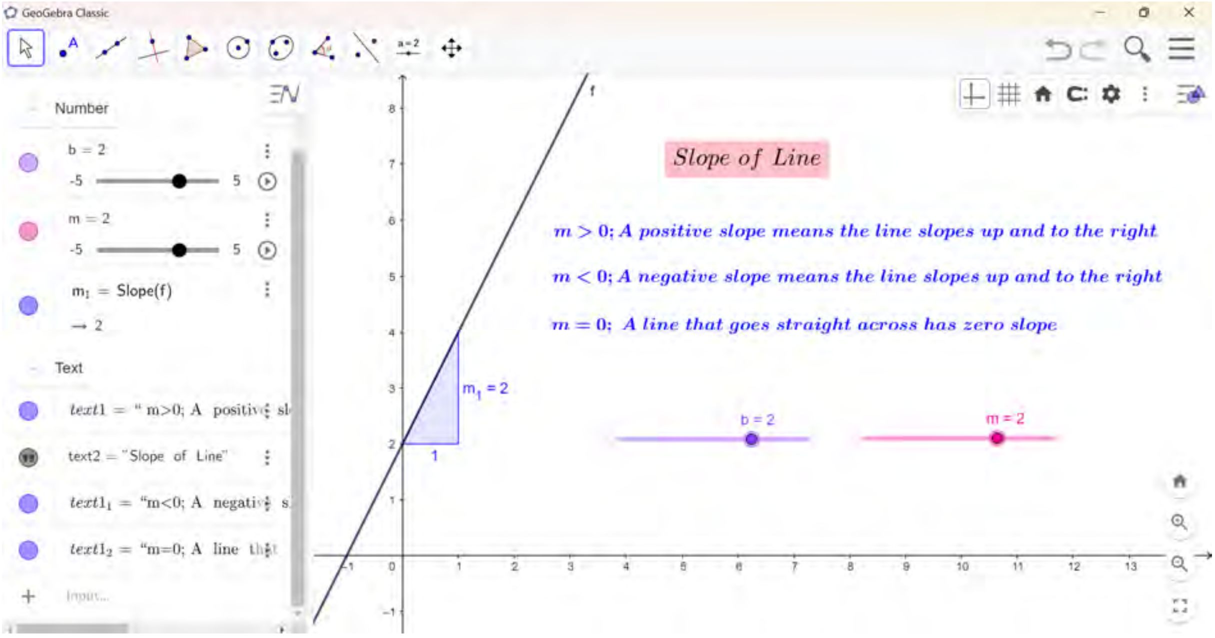

Figure 2. Worksheets of Question-1 in the slope of the line

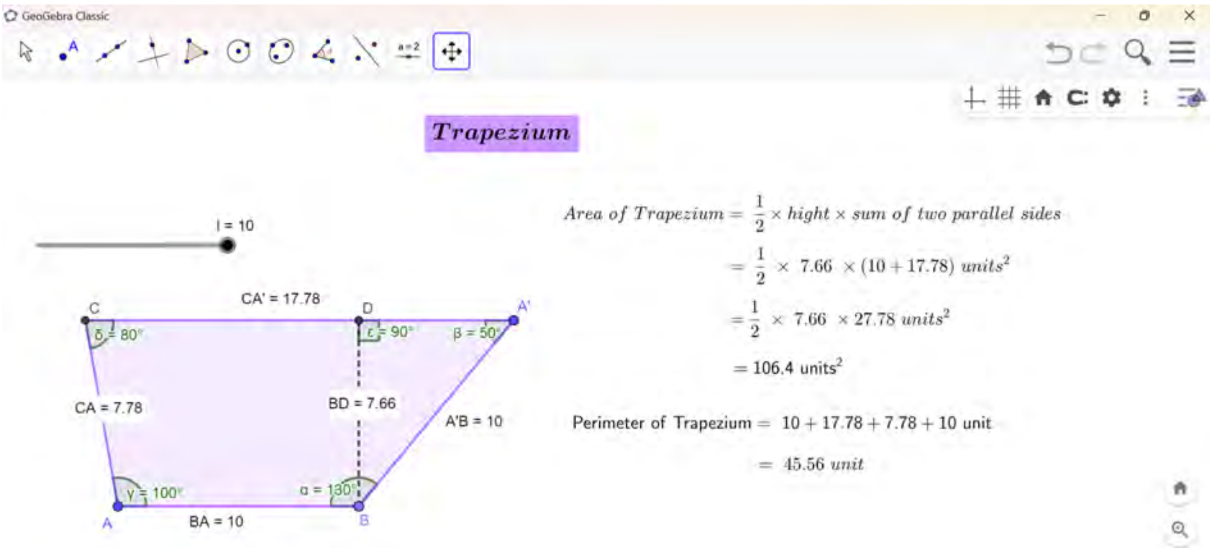

Figure 3. Worksheet of Question-4 in area and perimeter of Trapezium

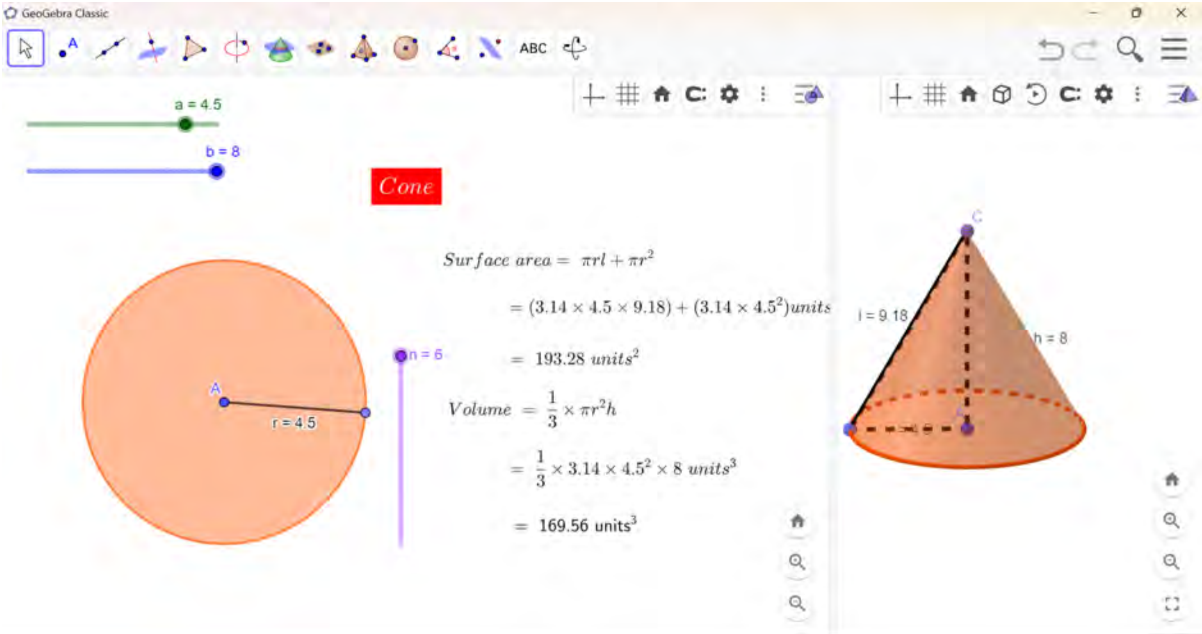

Figure 4. Worksheet of Question-10 in surface area and volume of Cone

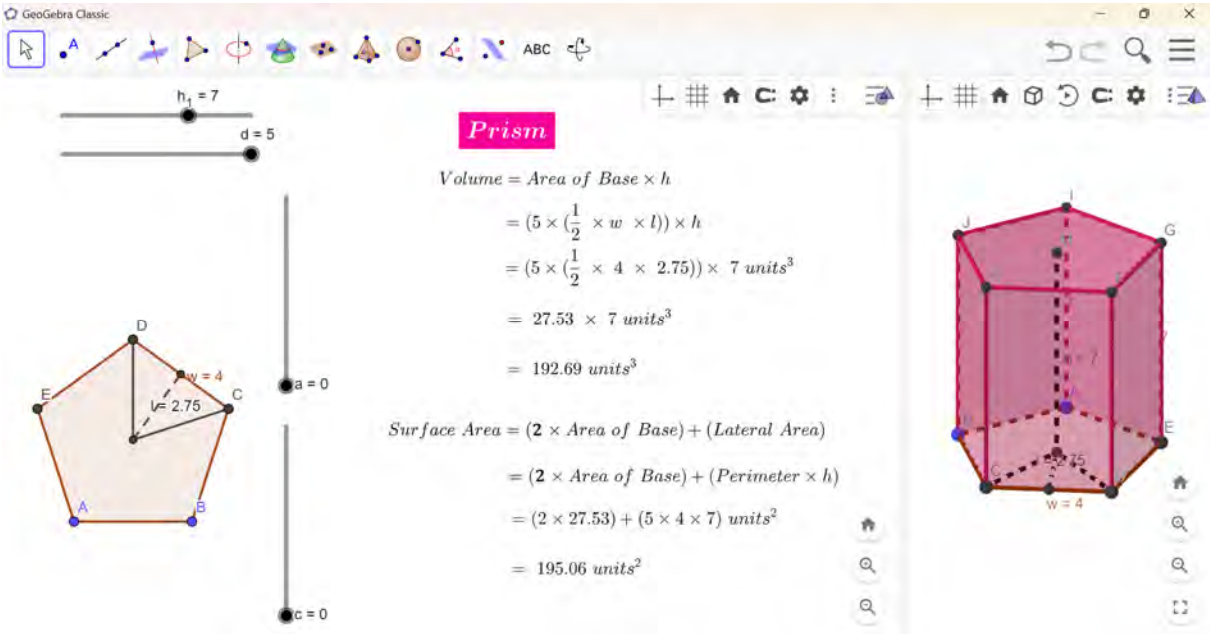

Figure 5. Worksheet of Question-12 in surface area and volume of Prism

2.2.3 Reliability of Tests and Questionnaires

In this study, all instruments—including the GAT, lesson plans, and questionnaires—were evaluated by experts before being used on the sample. Researchers used the Kuder-Richardson (Kuder & Richardson, 1937) number 20 reliability coefficient to figure out the item-objective congruence (IOC) index, the discriminant values, and the difficulty values of the GAT. The reliability of the questionnaires is evaluated using the Cronbach alpha value (Cronbach, 1990).

As part of the tryout, GATs and questionnaires were provided to thirty students. This was done to make sure that the surveys were true and to see how well the questions fit together. The GAT test had 30 multiple-choice questions and 12 subjective questions. The discriminant index ranged from 0.32 to 0.68, the difficulty ranged from 0.48 to 0.72, and the index of item-objective congruence (IOC) ranged from 0.67 to 1.00. The Kuder-Richardson formula for the GAT generated a reliability value of 0.84. The questionnaires had a Cronbach's alpha of 0.82, and the IOC index ranged from 0.67 to 1.00.

2.3 Data Analysis and Interpretation

This research is quasi-experimental with a pretest and posttest control group design (Edmonds & Kennedy, 2017). Table 2 presents a summary of the research design.

Table 2. Quasi-experimental design

Group	Pretest	Treatment	Posttest
Experimental	O_1	Treatment (teaching using a mastery learning approach through GeoGebra)	O_2
Control	O_1	Conventional teaching (lecturer)	O_2

The equivalence of the groups must be established prior to conducting the study (Büyüköztürk, 2008). Even though there was evidence that both groups were the same, the GAT was given to both groups as a pre-test to see if there were any differences in the skills and knowledge of geometry between the control group and the experimental group. The GAT was administered to students in both groups as a pre-test using an independent samples *t*-test with a $p = .05$ criterion of significance to confirm that the groups were comparable (Moore, 1995). The analyses were conducted using SPSS 28.0. The *t*-test of underlying assumptions must be satisfied prior to analysis. According to Büyüköztürk (2008), these are the assumptions of independence, normality, and homogeneity of variance. The first assumption was verified because the two groups consisted of different individuals and acted independently from one another. If the sample sizes were less than 50, the Shapiro-Wilks test should be used under the assumption of normality. P-values for the student scores in the experimental and control groups were.739 and $> .05$. These findings indicate that the second assumption was met. Finally, Levene's test for equality of variance was used to test the homogeneity of variance. To assume that the group variances are equal in this test, the significant value of p must be higher than the $p = .05$ level of significance (Tabachnick & Fidell, 2007). Levene's test gave a significant value of $p = .877 > .05$, which means that the differences between the student's geometry scores and the scores of the control groups were the same. The results of the independent samples t-test are displayed in Table 3 to check whether the groups were equivalent.

Table 3. Results of the independent samples *t*-test for the GAT pre-test scores of the experimental and control groups of students

Groups	n	mean	SD	*t*	df	Sig.
Experimental	30	50.30	5.90	.854	57	0.397*
Control	29	48.97	6.10			

Note. *p > .05

Table 3 showed that there was no statistically significant difference between the scores of the students in the treatment group (taught using a mastery learning approach through GeoGebra) and the students in the control group (M = 48.97, SD = 6.10); *t*(57) = .854, p = .397 > .05. These studies indicated that the groups were equivalent, allowing for the study to be conducted on them (Moore, 1995). In the post-test application of the GAT, the same process was used to determine students' overall scores as well as their scores on conceptual and procedural knowledge questions. The first assumption, that of independence, has already been proven accurate. The other assumptions (the assumptions of normality and homogeneity of variances) were met, as shown in Table 4.

Table 4. Results from the Shapiro-Wilk Test and Levene's Test to ensure the normality and equality of variance assumptions for treatment and control group students' scores on the GAT post-test

Scores gathered	Groups	Tests of Normality				
		Shapiro-Wilk Test (Assumption of Normality)			Levene's Test for Equality of Variances	
		Statistics	df	Sig.	F	Sig.
Procedural knowledge questions	Experimental	0.945	30	1.22*	0.082	0.776*
	Control	0.963	29	0.39*		

Note. *p > .05

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Table 4 revealed that all Sig. values in the Shapiro-Wilk Test were also more than the criterion of the significance of p = .05 for the procedural knowledge questions on the GAT post-test for both experimental and control group students. As a result, the independent samples t-test assumption of normality was met (Büyüköztürk, 2008). Additionally, Levene's test for the equality of group variances indicated that all of the group scores on the conceptual and procedural knowledge questions as well as all of the questions on the GAT post-test were all higher than the p = .05 level of significance. Consequently, the assumption of the homogeneity of variances was met (Tabachnick & Fidell, 2007). Therefore, all the assumptions underlying the independent samples *t*-test were met. The effectiveness of geometry instruction on students' learning of procedural knowledge about the applications of geometry was investigated by using the independent samples *t*-test (Fraenkel & Wallen, 1996). The same test was also used to compare the overall scores of students in the treatment group and the control group. This was done to see how well the mastery learning approach through GeoGebra helped teach the investigated topic. A summary of data analysis techniques can be seen in Table 5.

Table 5. Summary of data analysis techniques

Quasi-experimental design	
Experimental Group **(Teaching using a mastery learning approach through GeoGebra)**	**Control Group** **(Traditional Teaching)**
Five-step of the master learning process 1) Pre-Assessment First, a pre-assessment will be used to introduce course material that is related to the standard the teacher must teach. To ensure that students are prepared to go on to the current topic, this pre-test will check to see if they have already learned or mastered the necessary skills or knowledge. The teacher moves backward to make sure students understand the previous material before moving forward if they lack the necessary competencies. In this phase, the teacher will take a pre-test on the students using a Geometry Achievement Test (GAT) created by the researcher, which consists of 30 multiple-choice questions. 2) Instruction Once the students have shown that they know the most important skills or facts for the current topic, the teacher will start teaching using GeoGebra and a mastery learning approach. The mastery grading scale that will be used to assess students' levels of competency must be made clear to them by teachers. 3) Formative Assessment Following the instructional phase, instructors will use the GAT to evaluate students' abilities and knowledge (word problem). 4) Correction or Enrichment Instruction Teachers can differentiate instruction as needed once they have an understanding of where each student is in the mastery process. Those who have not shown	Four-step of traditional teaching 1) The researcher takes the pre-test before starting the lesson. 2) The researcher uses traditional teaching techniques, for the 12-lesson course covers both conventional 2D and 3D geometry. 3) Before beginning a new lesson, the researcher completes a post-test once each lesson is finished. 4) After finishing all the lessons, the researcher will take a test that consists of 30 multiple-choice questions.

mastery can get more appropriate education and practice opportunities from the teacher or lesson online through GeoGebra by following this link: https://www.geogebra.org/u/khansila_p. Students who have demonstrated high levels of competence can continue to expand their knowledge and skill sets through GeoGebra-specific worksheets and personalized enrichment instruction. 5) Summative Assessment The summative assessment is the process's last step. A GAT is used to assess each student's academic performance and use questionnaires to examine students' satisfaction with using a mastery learning approach through GeoGebra.	

3. Results

3.1 Independent Samples T-Test Results for Experimental and Control Groups Students' Overall Post-Test Scores in GAT

An independent samples *t*-test was utilized to compare the effect of using a mastery learning approach through GeoGebra in geometry. The comparison took into account the students' scores for geometric procedural knowledge. The analysis used a mastery learning approach through GeoGebra as the independent variable for the type of instruction (experimental and control groups). On the other hand, the dependent variables were students' scores related to conceptual and procedural knowledge and their overall scores gathered from students' responses to the GAT as a post-test. The type of instructions changed the post-test scores that were based on questions about the students' knowledge of geometry. The independent sample *t*-test is shown in Table 6.

Table 6. Independent Samples *t*-test results for experimental and control groups students' overall post-test scores in GAT

Groups	n	mean	SD	*t*	df	Sig.
Experimental	30	74.38	7.51	4.806	57	.000*
Control	29	64.87	7.68			

Note. *p < .05

For the student's overall post-test scores, a similar analysis was carried out. The independent samples *t*-test results indicated that there was a statistically significant mean difference for students' overall scores in the experimental group (M = 74.38, SD = 7.51) and that in the control group (M = 64.87, SD = 7.68); $t(57) = 4.806$, $p = .000 < .05$. This result showed that there was a mean difference of 9.51 between the group averages for the students. So, the students in the experimental group did much better on the GAT post-test than the students who were taught without using it. This led to the conclusion that teaching with GeoGebra and mastery learning is a significantly better way to teach geometry applications than teaching them without it.

3.2 Satisfaction of Using a Mastery Learning Approach through GeoGebra in Geometry for Mathematics Teacher Students

When the instructor is finished with the learning management, study the satisfaction of using GeoGebra towards learning to enhance academic achievement in geometry. Their opinion will affect the subsequent learning environment. Moreover, it supports instructors in creating and enhancing the management of learning and teaching. The researchers applied the data interpretation and analysis criteria of Kamasutra (1995), as shown in Table 7.

Table 7. Average score distribution and outcome interpretation

Range of average score	Interpretation
4.50-5.00	Very high
3.50-4.49	High
2.50-3.49	Moderate
1.50-2.49	Low
0.00-1.49	Very low

This study also used a 15-item questionnaire on geometry about the use of the mastery learning approach through GeoGebra. The results of this questionnaire are summarized in Table 8.

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Table 8. Students' satisfaction with using the mastery learning approach through GeoGebra to improve academic performance in geometry

Item	Mean	SD	Interpretation
1. I was excited about using the mastery learning approach through GeoGebra.	4.34	0.79	high
2. I enjoyed using the mastery learning approach through GeoGebra in the classroom.	4.06	0.91	high
3. I was very engaged in the learning process using GeoGebra.	4.44	0.62	high
4. I wasn't under any pressure while studying using the mastery learning approach through GeoGebra.	3.78	1.04	high
5. When I was unable to complete my assignments, I was dissatisfied	4.06	1.05	high
6. I enjoyed it when I was able to use the mastery learning approach through GeoGebra to establish a job.	4.56	0.56	very high
7. I learned a lot using the mastery learning approach through GeoGebra.	4.47	0.62	high
8. I am satisfied with the lesson using the mastery learning approach through GeoGebra.	4.28	0.77	high
9. I enjoy talking about using the mastery learning approach through GeoGebra with instructors through comments and Q&As	3.84	0.95	high
10. The management of teaching and learning promotes the growth of higher responsibilities at work	4.28	0.73	high
11. Using the mastery learning approach through GeoGebra promoted student involvement in the learning process	4.41	0.71	high
12. Using the mastery learning approach through GeoGebra to manage instruction gives students more space to express their thoughts and work together	4.28	0.73	high
13. The interaction between teachers and students was considerably enhanced using the mastery learning approach through GeoGebra	4.31	0.78	high
14. Using a mastery learning approach through GeoGebra allows me to produce a wide range of jobs	4.44	0.72	high
15. I was able to understand the lessons better through the variety of tasks performed using the mastery learning approach through GeoGebra	4.38	0.75	high
Overall average	4.26	0.81	high

The results from Table 8 show that students generally gave positive feedback toward using the mastery learning approach through GeoGebra in geometry. The study found that the items in the questionnaire that had the lowest mean were those that stated that students weren't under any pressure while studying GeoGebra, with a mean of 3.84. While the highest mean is 4.56, which is obtained for the sixth item: 'I enjoyed it when I was able to use GeoGebra to establish a job." The overall average student's satisfaction with the mastery learning approach through GeoGebra was high (mean = 4.26, SD = 0.81). In addition, students also found that GeoGebra can accurately reflect their math class learning. Using GeoGebra software can help students become more interested, confident, and motivated to study mathematics. The results showed that the people who used the mastery learning approach through GeoGebra to learn geometry were happy with their experiences.

4. Discussion

This study used a Geometry Achievement Test (GAT) and questionnaire to find out how well students' conceptual and procedural knowledge of geometry in 2D and 3D topics changed before and after the intervention. The results were systematically discussed and reported as follows.

The findings of the first subjective study reveal that mathematics teacher students' mathematical performance in two- and three-dimensional geometry who were using a mastery learning approach through GeoGebra were higher than students taught with conventional learning. There was also a significant difference in the post-test mean score of students taught geometry using the mastery learning approach through GeoGebra and conventional learning. This result corresponds with an investigation by Seloraji and Eu (2017), which found that GeoGebra improves students' performance in geometrical studies. Using GeoGebra to teach and learn geometry would allow students to explore the concept in greater depth while building and developing their geometry knowledge. This result is consistent with a study by Jelatu et al. (2018), which revealed that learning with the GeoGebra-supported REACT technique improves geometric concept knowledge more than traditional learning. This study's findings are in line with those of Zakariyya et al. (2016), who discovered significant differences in students' academic performance when geometry was taught utilizing a mastery learning approach. Adeniji et al. (2018) also found that using a mastery learning approach when teaching circle geometry to students greatly increased their geometry achievement. There was no gender difference found, as well as no difference in the achievement of the low-, medium-, and high-scoring students when taught with a mastery learning approach. This outcome is consistent with previous research by Worasarn et al. (2019), which found that GeoGebra improves students' mathematical achievement. Researchers also found that the number of students who were able to perform each of the questions increased drastically due to the potential of GeoGebra (Uwurukundo et al., 2022). The study recommends the use of a mastery learning approach through GeoGebra in all teaching and learning activities in mathematics.

The results of the second subjective test show that GeoGebra is a superb motivational tool. For teaching mathematics instructor students about dynamic geometry, GeoGebra is utilized as a visualization tool. The findings of the study demonstrated that using GeoGebra made it simpler to design and solve geometry problems. The interactions between students and teachers are better. There was still some pressure while creating the worksheets, but they enjoyed using GeoGebra software in the classroom and were satisfied with the worksheet that they had generated. Therefore, they had high levels of satisfaction with using a mastery learning approach through GeoGebra. Students will develop their learning effectively with the help of the mastery learning approach. According to a study, Shadaan and Leong (2013) employed survey tools to learn how students thought about using GeoGebra. Analysis of the survey responses revealed that most people had positive opinions about using GeoGebra to learn about geometry. This result corresponds with an investigation by Kanachan et al. (2020), which found that the satisfaction levels of students using GeoGebra were high. The use of GeoGebra makes it possible to visualize the idea of abstract geometry, making it more interesting and simpler for students to understand.

5. Conclusion

Every society needs smart, creative workers to develop new technologies, materials, and procedures. Finding outstanding students and preparing them for the workforce is a challenging endeavor that should begin in schools at a young age. Because of this, universities have an important role in identifying new technologies, models, methods, tools, and modes of education that may be used to prepare highly competent teachers for the educational labor market.

It can be concluded from the findings of the study that the mastery learning approach through GeoGebra improves students' academic performance. All students benefited equally when taught using a mastery learning approach through GeoGebra. Moreover, the mastery learning approach through GeoGebra is effective in influencing students' different scoring levels to achieve equality in a given task. GeoGebra helps mathematics teachers and students solve geometric problems while teaching and learning the subject. This research was based on the fact that the mastery learning approach through GeoGebra has proven to be significantly effective in enhancing the academic performance of mathematics teacher students in geometry. The majority of students generally had positive feedback about using a mastery learning approach through GeoGebra in geometry. Using GeoGebra can help students develop greater interest, confidence, and motivation in studying geometry. As a result, there was a high level of student satisfaction with learning management.

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