Optimizing The Use Of Geogebra With The Motiv-Learning Model: A Case Study Of Technologically Literate And Illiterate Students

Ade Fricticarani[1], Hamidah[2]*, Sigit Auliana[3], Jaka Wijaya Kusuma[4]

[1]Department of Information Technology Education, Universitas Bina Bangsa, Indonesia
[2,4]Mathematics Education Department, Universitas Bina Bangsa, Indonesia
[3]Computer Science Department Universitas Bina Bangsa, Indonesia
Email: adefricticarani@gmail.com[1], shiroimida@gmail.com[2], pasigit@gmail.com[3], jakawijayak@gmail.com[4]
*Corresponding Author

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ABSTRACT
The purpose of this study is to investigate the effectiveness of the Motiv-Learning model assisted by the Geogebra application on the mathematical connection ability of technologically literate and technologically illiterate students. The research method in the first stage uses quantitative methods to obtain quantitative data, then in the second stage uses qualitative methods to deepen, expand, and prove quantitative data. The subjects of the study were selected two schools that are classified as technology-blind groups, namely SMPN 1 Tanara which is located in Serang district and SMPN 1 Ciruas which is classified as a technology-literate group located in the middle of Serang city. The sample was selected by 43 students of SMPN 1 Tanara grade VIII and 40 students of SMPN 1 Ciruas grade VIII who were selected by purposive sampling. The instruments used are a description test to assess the ability to make mathematical connections and an interview sheet to get feedback from students. The interviewed students were selected from the categories of mathematical connection skills (high, medium, and low) of each class group. The quantitative data analysis technique uses a percentage formula and an average difference test, then the quantitative data analysis technique uses data analysis consisting of data reduction, data presentation, and conclusion drawing or verification. The results showed that the use of the Motiv-Learning model with the Geogebra application was more optimal, affecting the mathematical connection ability of students who were classified as technologically literate. Students who are in the technology-blind group who are classified as high, medium, and low connection abilities need to increase their learning time at school and practice at home more often using the Geogebra application to hone their skills in utilizing technology in learning. For students who are in the technology literacy group that is classified as a category of low connection ability, it is necessary to practice more often at home using the Geogebra application to hone their skills in using the Geogebra application. By continuing to deepen this understanding, educators can develop more effective strategies in utilizing technology to improve students' overall math connection abilities.

Keywords: ICT,technologically, geogebra, mathematical connection ability, motiv-learning model.

INTRODUCTION

Mathematics education is an integral part of education that develops students' logical, analytical, and creative thinking skills. One branch of mathematics that requires a strong understanding and good visualization is geometry [1]–[3]. Geometry requires not only an understanding of basic concepts such as flat and spatial figures, but also the ability to visualize these objects in dimensional space. Geometry is considered an important lesson because it can develop spatial skills, problem-solving skills, understanding mathematical concepts, build logical thinking skills, and increase creativity and innovation. With these various benefits, geometry is not only an important lesson in the educational curriculum, but it also provides a solid foundation for students' future intellectual and professional development.

In the context of modern education, the integration of ICT (Information and Communication Technology) has opened up many opportunities to enrich students' geometry learning experience [4], [5].Despite the great potential of ICTs in improving geometry learning, there are challenges that need to be overcome.

One of the main challenges is the digital divide between students who are skilled in technology and those who are not. Students who are not tech-savvy may have difficulty accessing and utilizing digital resources to support their geometry learning. This can hinder their potential to understand geometry concepts in depth and develop the necessary visualization skills.

The research will be conducted in junior high schools in a city that has diverse levels of access to technology among its students. Based on preliminary studies, it is known that these schools represent social, economic, and cultural diversity that reflects the student population in the region. As a city that has differences in the level of understanding and access to technology among students from different socio-economic backgrounds. Some students have limited access to technology devices such as computers or tablets in their school, while others have full access and use of technology in their daily lives in their school.

In recent years, many innovations and developments have occurred in the application of ICT in mathematics learning, including geometry. Technologies such as dynamic geometry applications, 3D simulation, augmented reality (AR), and virtual reality (VR) have offered new approaches to teaching geometry concepts visually and interactively [6]–[8]. The app not only enriches the student's learning experience but also facilitates active exploration of abstract geometric objects. Geogebra is one of the applications of ICT in mathematics learning that is very useful and effective for geometry learning. The advantages of using the Geogebra application are that it provides an interactive and visual environment, is able to visualize complex mathematical relationships, and allows the creation of simulations and animations that enrich the student learning experience [9], [10].With these advantages, Geogebra is not only a powerful tool for learning geometry in the classroom, but also facilitates an in-depth, interactive, and fun learning experience for students in understanding abstract mathematical concepts.

However, the effectiveness of the use of the Geogebra application still requires further research, especially in the context of the diversity of access and technology skills among students. This research will focus on the application of the Motiv-Learning model, which is an approach that combines students' intrinsic motivation with learning technology, to optimize geometry learning. The Motiv-Learning model is a learning approach that focuses on generating students' intrinsic motivation through the use of relevant learning technologies and content [11]–[13]. In the context of geometry, the Motiv-Learning model approach assisted by the Geogebra application combines the following elements: 1) Learning personalization, which is using the Geogebra application to provide a learning experience tailored to the needs and interests of individual students in understanding geometry concepts; 2) Interactivity, which is utilizing the interactive features of the Geogebra application, such as visual manipulation of geometric objects and exploration of geometric spaces in a virtual environment; 3) Collaboration, which encourages collaboration between students in solving geometry problems through the Geogebra application, increasing involvement and discussion in the learning process; 4) Real-time feedback, which is using the Geogebra application to provide direct feedback on students' progress in understanding geometry concepts, helping them to identify weaknesses and develop problem-solving strategies.

One of the basic mathematical skills that students must have in learning mathematics is the ability to make mathematical connections. The ability to connect mathematics has three indicators, namely the ability to connect concepts between topics in mathematics to solve mathematical problems, connect mathematical concepts with concepts of other subjects, and connect between concepts to solve problems in everyday life [14]–[16]. The use of the Geogebra application is beneficial in improving students' mathematical connection skills in a significant way [17]–[19], Among them: 1) Geogebra allows students to visualize geometric concepts directly and interactively. They can see how lines, angles, and other geometric shapes are formed and interact with each other by manipulating objects on the screen. This helps students to develop a deeper understanding of geometric relationships; 2) Geogebra not only allows students to visualize geometric concepts, but also to integrate other mathematical concepts. For example, they can see how a line equation or mathematical function relates to its geometric graphical representation. This helps students to build connections between different mathematical concepts and understand the whole picture. As such, Geogebra is not just a teaching aid, but also a powerful tool to improve students' understanding of mathematics through interactive visualization, active exploration, concept integration, collaboration, and a deep understanding of how mathematics relates to the real world.

This study aims to investigate the effectiveness of the Motiv-Learning model using the Geogebra application in improving the mathematical connection ability of students who have a spectrum of technology access, from the technologically literate to the technologically illiterate. So the objectives of this research are:

1. To investigate the effectiveness of the Motiv-Learning model assisted by the Geogebra application on students' mathematical connection skills.

2. Evaluate the difference in the achievement of mathematical connection skills between tech-savvy and tech-blind students in the context of using Geogebra applications.

By exploring these questions, this research is expected to provide valuable insights into how technology can be optimized to improve geometry learning in today's digital age.

RESEARCH METHODS

This study uses quantitative and qualitative research methods, in the first stage it uses quantitative methods to obtain quantitative data, then in the second stage it uses qualitative methods to deepen, expand, and prove quantitative data. Quantitative research is a research method that relies on the collection and analysis of numerical data to measure, describe, explain, or predict, as well as make generalizations broadly (Mertler, 2020).While qualitative research is interactive research in which researchers are involved in continuous and continuous experiences with participants, this involvement will later give rise to a series of strategic, ethical, and personal issues in the qualitative research process [21].

The independent variable in this study is the use of the Motiv-Learning model with the help of the Geogebra application and the dependent variable is the ability of students' mathematical connections. The research group is students from the group who are technologically literate and technologically illiterate. The subject of the study was chosen two schools, namely SMPN 1 Tanara located in Serang district and SMPN 1 Ciruas located in the middle of Serang city. The assumption is based on initial observations, namely that students at SMPN 1 Tanara are classified as technology-illiterate students and students at SMPN 1 Ciruas are classified as technology-literate students. The sample was selected from 43 students of SMPN 1 Tanara grade VIII and 40 students of SMPN 1 Ciruas grade VIII who were selected by purposive sampling.

The instruments used were tests to assess mathematical connection skills before and after the intervention, and interview sheets to get feedback from students about the learning experience with the Motiv-Learning model assisted by the Geogebra application and about the connection questions given. The test instrument is in the form of three description questions made based on three indicators of students' mathematical connection ability that have been tested and have been declared valid for use. The research procedure is that both classes will be given the same tests and learning. The implementation of the Motiv-Learning model intervention with the help of the Geogebra application is:

1. The development of learning materials is to create interactive learning modules with the Geogebra application which includes triangle and quadrilateral concepts.
2. The learning session is to implement a learning session facilitated using the Motiv-Learning model, with a focus on driving students' intrinsic motivation for mathematical exploration through the Geogebra application.
3. Monitoring and guidance is monitoring student progress, providing individual guidance as needed.

Data collection began with conducting a pre-test to find out the students' mathematical connection skills before the intervention. Furthermore, after the intervention, a post-test was carried out to determine the students' mathematical connection ability after the intervention using the Motiv-Learning model assisted by the Geogebra application. Post-test results are categorized into high, medium, and low categories. Additional data collection is to conduct interviews to get feedback from students about learning using the Motiv-Learning model assisted by the Geogebra application and about the connection problems given. The interviewed students were selected from the category of mathematical connection skills of each class group.

The quantitative data analysis technique uses a percentage formula and an average difference test, but previously a normality test and a homogeneity test were carried out. Furthermore, quantitative data analysis techniques use data analysis consisting of data reduction, data presentation, and drawing conclusions or verification [22].The stages are: 1) Data reduction, namely the correction of the results of the math connection ability test of students in both classes; 2) Data presentation, namely the results of student work on the mathematical connection ability test, are presented in a table of high, medium, and low categories based on groups of technologically literate and technologically illiterate students. Then, the results of interviews with students are presented in the form of descriptions based on the outline of the research problem; 3) Drawing conclusions, namely drawing conclusions from the data reduction process and presenting data to answer the formulation of the research problem.

RESEARCH RESULTS

1. Results of the Description of the Student Mathematics Connection Ability Test

The data of the pre-test and post-test scores of the mathematical connection ability of the two classes are presented in the following table:

Table 1. Description of Mathematics Connection Ability Test ScoreTes

	Class Groups	N	Min	Max	Average	SD
Pre-test	Group I (Technology Blind Student Group/BT)	43	0	35	14.63	9.98
	Group II (Technology Literacy Student Group/MT)	40	0	35	16.87	10.17
Post-tes	Group I (Technology Blind Student Group/BT)	43	33	75	63.23	12.42
	Group II (Technology Literacy Student Group/MT)	40	45	90	76.5	11.56

Table 1. It is the result of the calculation of the description of the pre-test and post-test data of both classes. In general, it is known that the score of the mathematical connection ability test of group I students is superior to that of group II students, both pre-test and post-test scores. Furthermore, a follow-up test will be carried out to find out the significant difference in the value.

2. Results of Normality and Homogeneity Tests

As a prerequisite test for the mean difference test, the normality test and homogeneity test are carried out which are presented in the following table.

Table 2. Normality Test of Both Classes

Score	Class	Shapiro-Wilk		
		Statistic	Df	Sig.
Pre-test	Group I	.925	43	.123
	Group II	.965	40	.675
Post-test	Group I	.945	43	.442
	Group II	.917	40	.089

Based on table 2, it is known that the significance value of the pre-test and post-test of the mathematical connection ability of students in group I and group II is all > 0.05. This means that Ho was accepted, based on the results of the test, it was concluded that the data of the four groups were normally distributed. The next test is the homogeneity test, the results of the calculation are presented in the following table.

Table 3. Homogeneity Test of the Second Class

Score	Levene Statistic	df1	df2	Sig.
Pre-test	.073	1	81	.789
Post-test	.360	1	81	.552

Based on table 3. It is known that the significance value of the pre-test and post-test scores of the students' mathematical connection ability of the two groups is all > 0.05. This means that Ho was accepted, based on the results of the test, it was concluded that both groups of students, both pre-test and post-test data, came from populations with the same variance (homogeneous).

3. Average Difference Test Results

After it was known that the pre-test and postest data groups were normally and homogeneously distributed, the follow-up test used to determine the significance of the average difference was the One Way Anova test. The calculation results are presented in the following table.

Table 4. One Way Anova Pre-test Test Results

Ability_Connection	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	260.100	1	260.100	1.390	.130
Within Groups	4135.800	81	51.059		
Total	4395.900	82			

The results of the calculation of the One Way Anova test for pre-test data are known to have a significance value greater than 0.05 which means that the hypothesis is rejected. This means that in the initial condition, both groups of students before being given the intervention had balanced mathematical connection skills. Furthermore, the results of the calculation of the One Way Anova test for the following post-test data are presented.

Table 5. One Way Anova Post-test Test Results

Ability_Connection	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Between Groups	81.225	1	81.225	5.980	.001
Within Groups	1558.750	81	19.243		
Total	11639.975	82			

The results of the calculation of the One Way Anova test for post-test data are known to have a significance value of less than 0.05 which means that the hypothesis is accepted. This means that there is a difference in the mathematical connection ability of the two class groups after being given the intervention. Based on the descriptive score, it is known that the average post-test of group II is higher than that of group I, so it is concluded that the mathematical connection ability of group II students (technology-literate class group) is significantly better than that of group I students (technology-blind class group)).

4. Post-test Score Distribution Results

The depiction of the distribution of post-test scores of the two class groups is classified in the form of intervals. Based on the post-test scores of the students' mathematical connection ability of the two class groups, the distribution of scores is categorized into 3 groups, namely high, medium, and low. The following are the results of data processing to classify student scores.

Post-test score interval : 90 – 33 = 57
Interval of each category : 57 : 3 = 19
High Category : 71 ≤ Score ≤ 90
Medium Category : 52 ≤ Score ≤ 70
Low Category : 33 ≤ Score ≤ 51

Based on this classification, then the post-test score data of the two groups is presented in the following table.

Table 6. Categories Post-test Score Mathematics Connection Ability

Category	**Kelompok I (Technology Blind Student Group/BT)**		**Group II (Technology Literacy Student Group/MT)**	
	F	**%**	**F**	**%**
High	16	37.21	28	70
Medium	18	41.86	8	20
Low	9	20.93	4	10
Total	43	100	40	100

Based on table 6, it shows that the majority of group I is classified as medium category, which is 41.86%. Meanwhile, in group II, the majority of students are classified as high category, namely 70%. Group I and group II are known to have the same initial ability. So that the post-test results are assumed to be caused by the learning process that students receive. Table 6 explains that the group of students who are tech-literate are able to improve their abilities with the Motiv-Learning learning model assisted by the Geogebra application compared to the group of students who are tech-blind. However, in group II, there are still 20% of students with medium categories and 10% of students with low categories. So it is still necessary to conduct an in-depth analysis of students' responses to the applied learning. Furthermore, the results of students' work in solving mathematical connection skills based on student categories will be analyzed, and the results of student interviews will also be presented to their responses to solving problems and learning given.

5. Results of Student Work Analysis and Student Interview Results

Group I is a group of classes that are tech-blind/BT, which is a group of classes whose schools do not facilitate technology-based learning. In addition, BT group students come from families with lower middle ability so that almost all students do not have computers or laptops at home. So students are still very unfamiliar with technology-based learning. While group II is a group of technology-literate classes/MT, which is a group of classes whose schools facilitate technology-based learning, namely there is a computer laboratory and each class has an infocus. So that almost all students have been taught with technology-based learning. This is a highlight in developing technology-based learning, because the concern of forcing technology-based learning on students who are not used to it will have positive consequences but can also have negative consequences.

Furthermore, some of the answers of group I and group II students in solving mathematical connection skills will be analyzed. Problem number 1 is an indicator of mathematical connection ability, namely "the ability to use conceptual relationships between topics in mathematics to solve mathematical problems". The following is question number 1 used:

1. One of the baduy batik motifs is Simbut batik like the leaf shown in figure 1.

Figure 1

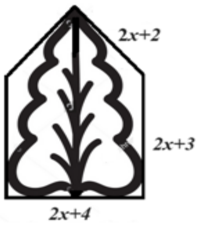


Figure 2

Batik craftsmen want to make their molds with wood as shown in picture 2. It is known that the height of the mold is $4x+3$ and the circumference of the wood used to make the mold is 54cm. Determine the size of the mold that the craftsman made!

Figure 1. Indicator 1 Mathematics Connection Ability Questions

From this question, students gave various answers. The following are the results of student answers based on categories and groups of students. The results of the answers were discussed and analyzed based on the results of interviews with students about connection questions and about the learning model given during learning.

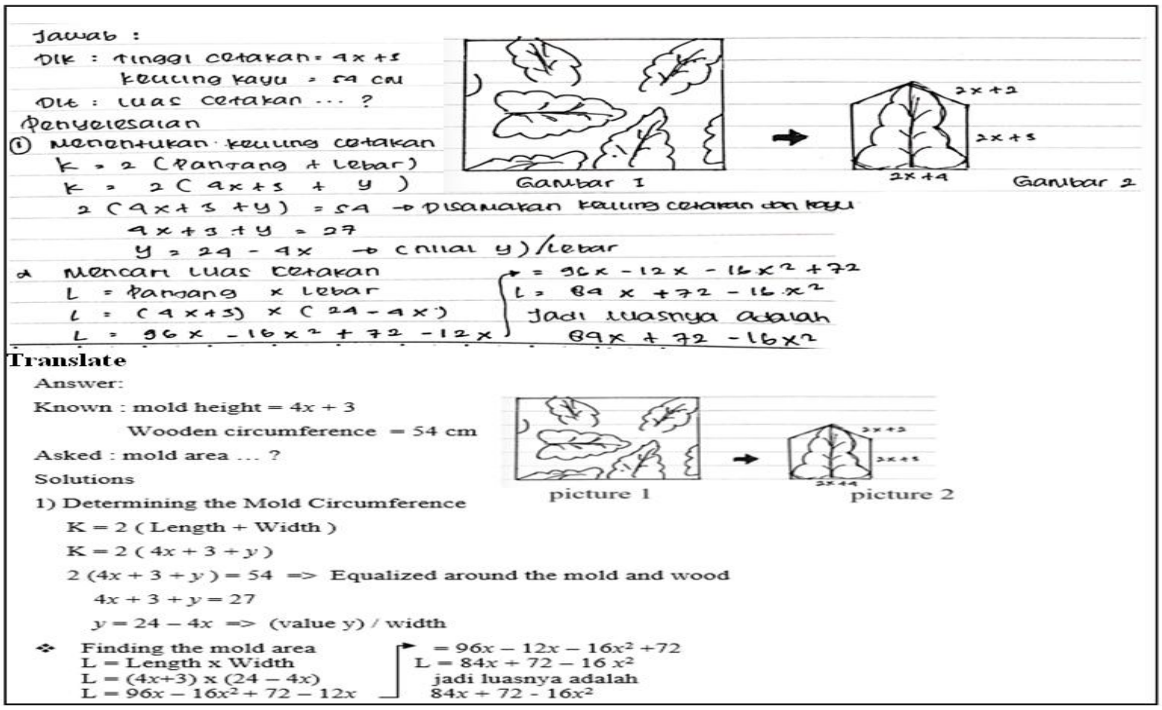
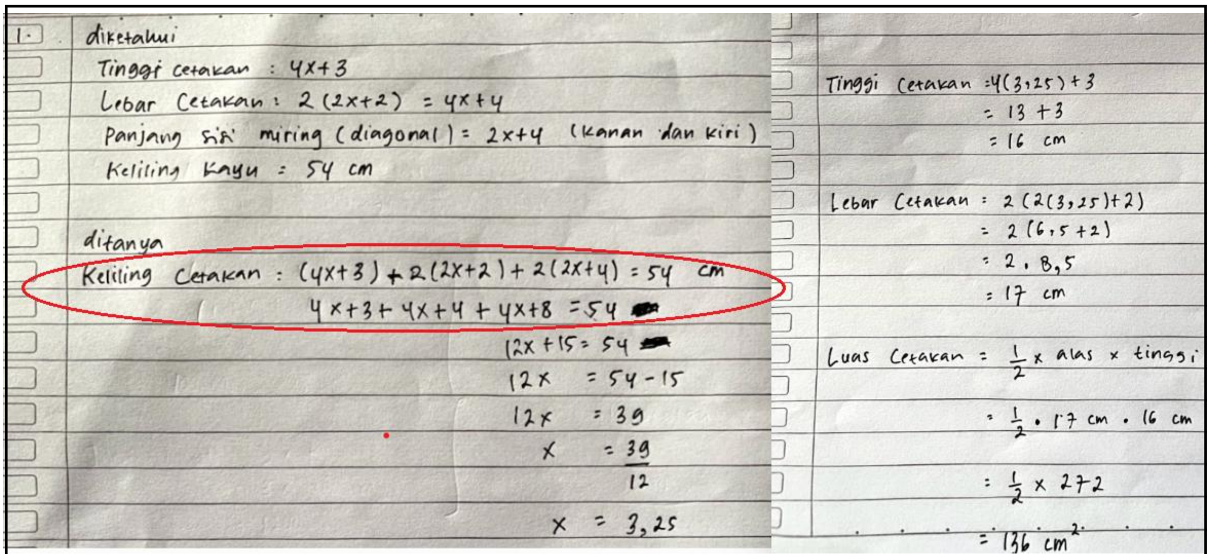


Figure 2. Student Answer Results (MD) High Category Group II

Figure 2 is the result of the answers of students whose mathematical connection skills are relatively high. Students with the initials MD are students who are in group II, namely students who are classified as technologically literate. The MD answer is the correct answer with the appropriate steps. The work of the MD has clearly shown that students can illustrate the mold referred to in the problem formed from two flat shapes, namely a triangle and a quadrilateral. Students seem to be accustomed to re-describing what is known so that the questions become easier to understand. In accordance with the expected indicators, students are able to use the relationship between the concepts of area and the circumference of a flat building (triangles and quadrilaterals) to complete the area of the overall building. Based on the results of the interview, MD stated that question number 1 was very easy and when reading the question, the student admitted that he could already imagine the steps to be used. The student admitted that his habit of using Geogebra to create flat buildings and dividing a flat figure into other flat building pieces inspired him to solve problem number 1. According to previous research, the use of the Geogebra application in learning can help students become illustrative thinkers [23], [24]. Geogebra not only facilitates an in-depth understanding of mathematical concepts, but also stimulates students to think illustratively and creatively in exploring mathematics.

Group II students are used to technology-based learning, so when learning using the Geogebra application, almost all students show interest. Students participate in learning casually and actively. Students stated that previously they did not like learning geometry, but after being taught with the Geogebra application, students became fond of geometry and often watched tutorials proving the formula of building a flat area with the Geogebra application through youtube. Student interest is facilitated with adequate facilities and a learning process that is also based on motivating students, so that it has a very good impact on student knowledge. In other words, learning with the Motiv-Learning model assisted by the Geogebra application is very suitable for students who are tech-savvy.


1. diketahui
Tinggi cetakan : 4x+3
Lebar Cetakan : 2 (2x+2) = 4x+4
Panjang sisi miring (diagonal) = 2x+4 (kanan dan kiri)
Keliling kayu : 54 cm
ditanya
Keliling Cetakan : (4x+3) + 2(2x+2) + 2(2x+4) = 54 cm
4x+3+ 4x+4 + 4x+8 = 54
12x + 15 = 54
12x = 54 - 15
12x = 39
x = 39/12
x = 3,25
Tinggi cetakan = 4(3,25) + 3
= 13 + 3
= 16 cm
Lebar Cetakan : 2 (2(3,25)+2)
= 2 (6,5 + 2)
= 2 . 8,5
= 17 cm
Luas Cetakan = 1/2 x alas x tinggi
= 1/2 . 17 cm . 16 cm
= 1/2 x 272
= 136 cm²

Translate:

1. Known:

Mold height = $4x + 3$

Mold width = $2(2x + 2) = 4x + 4$

Beveled side length (diagonal) = $2x + 4$ (right and left)

Wooden circumference = 54 cm

Asked:

Mold circumference = $(4x + 3) + 2(2x + 2) + 2(2x + 4) = 54$ cm

$4x + 3 + 4x + 4 + 4x + 8 = 54$

$12x + 15 = 54$

$12x = 54 - 15$

$12x = 39$

$x = 39 / 12$

$x = 3{,}25$

Mold height = 4 (3,25) + 3

= 13 + 3

= 16 cm

Mold width = 2 . (2. (3,25) + 2)

= 2 . (6,5 + 2)

= 2. 8,5

= 17 cm

Mold area = ½ x width x Height

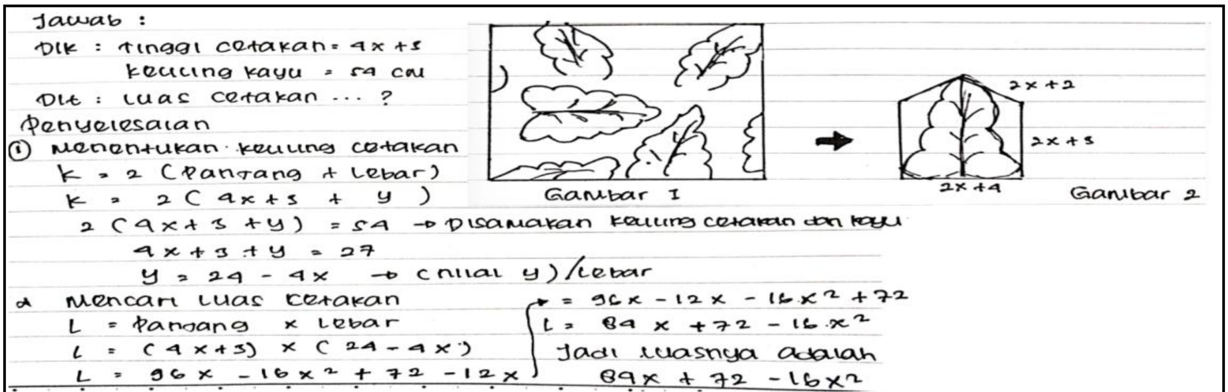
= ½ . 17cm . 16cm

= ½ x 272

= 136 cm²

Figure 3. Student Answer Results (WN) High Category Group I

Figure 3 is the result of the answers of students whose mathematical connection skills are relatively high. Students with the initials WN are students who are in group I, namely students who are classified as technology illiterate. WN's answer is an inappropriate answer. Almost all of the answers of students who were classified as high category in group I gave similar answers. Students seem unaccustomed to re-describing the given questions, so students' views on the questions are less comprehensive. For example, in the circle marked in figure 3. shows the lack of thoroughness of students completing the circumference of the mold. After being confirmed, the student admitted that he was not careful to write down one of his sides. In fact, if it is redrawn, the description on the question will be more clearly written. This is certainly fatal to the final result, because the x-value found is not accurate. Based on indicator 1 of mathematical connection ability, students can already find conceptual relationships between topics to solve the problems they face but are still wrong in using them.
The results of the interview showed that students felt pressured by learning using Geogebra. According to students, the menus in the application are very complicated to understand, so understanding the material becomes more difficult. Students admit that the teacher's approach to learning is fun, but the participation in the use of the application makes students not interested. This was also confirmed to other students in group I, and the result was that almost all students expressed initial interest in learning variations using infocus media. Because he never learned with infocus, he said. However, when asked to understand how to learn with the Geogebra application, students admitted that it was difficult. There were some students who expressed their satisfaction with the illustrations and visualizations that were aired from the Geogebra application, but still admitted that the material presented was poorly understood by students. All students admitted that there were no laptops or computers at home and there were no computer facilities at school, so the use of the Geogebra application could not be done again when given homework practice questions. In conclusion, the Motiv-Learning model can be used in the tech-blind group as well as in the tech-literate group. However, students with technology-blind backgrounds cannot participate in learning optimally with technology-based learning, one of which is the Geogebra application. The use of applications such as Geogebra, requires adequate infrastructure in schools [17], [25].If schools do not have adequate facilities such as sufficient hardware, stable internet access, or adequate training for teachers, then the implementation of technology-based learning such as using Geogebra may not be able to be done properly and optimally and even not at all. Because it is a real obstacle in utilizing the full potential of technology to improve student learning.



Translate

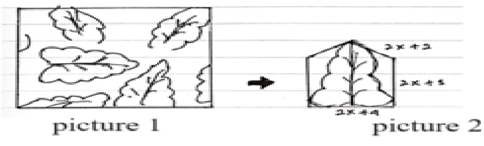
Answer:

Known : mold height = $4x + 3$

Wooden circumference = 54 cm

Asked : mold area ... ?

Solutions



1) Determining the Mold Circumference

K = 2 (Length + Width)

K = 2 ($4x + 3 + y$)

2 ($4x + 3 + y$) = 54 => Equalized around the mold and wood

$4x + 3 + y = 27$

$y = 24 - 4x$ => (value y) / width

- Finding the mold area
  L = Length x Width
  L = ($4x$+3) x (24 − $4x$)
  L = $96x - 16x^2 + 72 - 12x$
  = $96x - 12x - 16x^2 + 72$
  L = $84x + 72 - 16x^2$
  jadi luasnya adalah
  $84x + 72 - 16x^2$

Figure 4. Student Answer Results (MH) Low Category Group II

Figure 4 is the result of the answers of students whose mathematical connection skills are relatively low. Students with the initials MH are students who are in group II, namely students who are classified as technologically literate. MH's answer was incorrect, but MH wrote down what was known in full along with pictures and provided steps to solve it. Students do not understand the concept of circumference and flat building area. As a result of the interview, MH stated that learning with the Geogebra application was very interesting but students had difficulty understanding the material. The students admitted that they did not like geometry lessons, but the results of the students' work showed that students began to like drawing flat figures. According to students, the learning process with the Motiv-Learning model motivates students to follow the learning and encourages them to engage in discussions and understand the material.

Direct practice using the Geogebra application in learning and in problem solving also stimulates students to try to manipulate when faced with problems in the form of flat wakes. The facilities provided by the school in the form of computer laboratories make it easy to teach students with technology-based learning. This is because students can freely conduct trials and practice solving geometry problems with the Geogebra application. However, students stated that sometimes when they were trying to understand the material presented and tried to solve the problems given with the Geogebra application, suddenly the lesson hours ran out. At that moment, the student immediately ended his curiosity, and the understanding of the concept of the material or the problem that was being solved was not resumed. Finally, it became ignorance that continued until the end. The speed at which students understand the material varies [26], [27].Even though they are motivated and have supportive facilities, students whose ability categories are relatively low need to increase their learning time and increase hours to hone their skills by frequently completing practice questions.

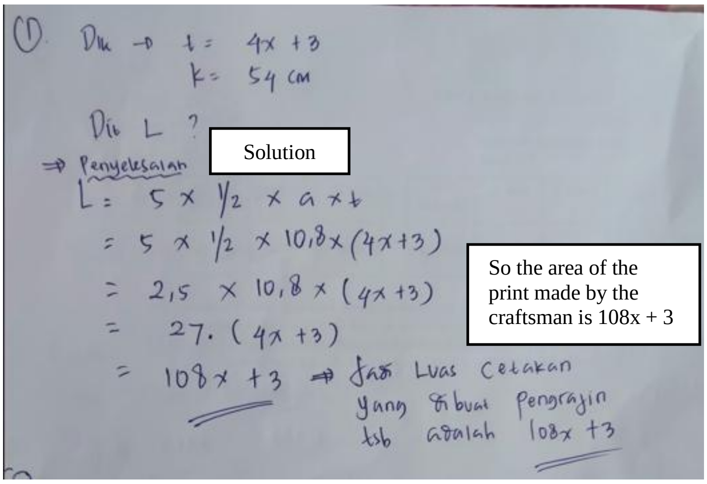


Figure 5. Low Category Student Answer Results (RM) Group I

Figure 5 is the result of the answers of students whose mathematical connection skills are relatively low. Students with the initials RM are students who are in group I, namely students who are classified as technology illiterate. RM's answer is a wrong answer, both his steps and his understanding of the problem. Short and concise answers are sometimes a characteristic of someone who lacks thinking. Students do not understand the problems or the concept of the material, so they do not know what steps to use and how to utilize the information known from the questions.

The results of interviews with students showed that students did not like mathematics lessons. How to like geometry lessons, even math lessons in general are not liked. The use of the Geogebra application does not have a significant impact on student understanding. According to students, the Geogebra application makes the material more difficult to understand. This is certainly not because the Geogebra application makes the material difficult to understand, but because students are not used to using the application in learning.As it is said Griffith et al., (2020), one loves technology-based learning because it is used to using applications in learning. RM admitted that the visualization displayed on the Geogebra application attracted his attention, but according to him, the teacher's explanation was not long and the students could not practice directly freely. Teachers admit that the lack of school facilitation such as the absence of computer laboratories is an obstacle to students' knowledge. The simulation of the Geogebra application cannot be practiced freely to students because the teacher only has one laptop and brings his own infocus from home. So students have to take turns using the Geogebra application in front of the class. In addition, the learning time at school is very short and constrained by facilities at home which also do not have laptops or computers, so that students have difficulty understanding in depth the use of the Geogebra application in solving problems.

DISCUSSION

The results of the study show that the mathematical connection ability of students who are given learning with the Motiv-Learning model assisted by the Geogebra application is more optimally given to students who are tech-literate than those who are tech-blind. The group of students who are technologically literate in this study means students who are used to technology-based learning, whose school facilitates technology-based learning and is equipped with a computer laboratory and also has a computer or laptop at home. School facilities that support technology-based learning play a crucial role in creating a modern, effective, and inclusive learning environment [29]–[31]. By ensuring adequate access to hardware, software, training for teachers, and technical support, schools can create an environment that supports the use of technology to significantly improve student learning. It's not just about bringing technology into the classroom, it's also about optimizing its use to develop the skills and understanding students need to face increasingly digital global challenges.

The Motiv-Learning model is a learning approach that integrates students' intrinsic motivation to increase students' motivation to follow the learning process so as to improve students' abilities and learning outcomes. The concept of the Motiv-Learning model refers to the drive or desire that comes from within students to learn and achieve academic goals, the main focus is to cultivate and maintain student motivation to follow the learning process from the beginning to the end of learning. Its application is packaged into active learning, where students are encouraged to be actively involved in the learning process. This includes concept exploration, problem-solving, group discussions, and challenging projects. At the beginning of learning, the Motiv-Learning model always sets relevant learning goals for students. When students feel that what they are learning has a direct relevance to their lives or their academic goals, they are more likely to be motivated to study more vigorously [32], [33].

Applied in the field, the Motiv-Learning model integrates technology, instruction differentiation, and emphasizes the relevance of learning to students' lives. The Motiv-Learning model is designed not only to deepen students' understanding of concepts, but also to prepare students for success in an increasingly complex and digitally connected world. Effective implementation of the Motiv-Learning model requires commitment from schools, support from management, and investment in teacher professional development to achieve optimal learning outcomes for all students. This is known from the results of research that shows that students in the tech-literate group follow learning comfortably and actively, while students in the tech-blind group follow learning in a depressed and passive manner. This fact shows that it is necessary to improve technology-based learning for schools that do not have adequate facilities. This fact is also supported by the student's statement, students find it difficult to follow learning using the Geogebra application. As conveyed by Perienen, (2020)that school facilities are the key to strongly supporting technology-based learning.

Geogebra as the application used in this study, offers a powerful platform for mathematical visualization and interactive exploration of concepts. With this combination, students become more involved in the learning process, increase their motivation, and deepen their understanding of mathematical concepts [34].When learning using the Geogebra application, students are trained to visualize mathematical concepts dynamically. They are geared towards creating geometric drawings and exploring the relationships between various mathematical objects in an intuitive way. For example, students can see how the formula for the area of a triangle is found from the area of a triangle. Students also conduct hands-on geometry experiments by combining different flat shapes in a single platform. In conclusion, implying the use of the Geogebra application in learning requires careful planning by teachers so that the learning process takes place optimally according to the planned target.

Both the technology-blind class group and the technology-literate class group are given the same treatment, but provide different learning outcomes. Based on the results of the study, it was found that students who are tech-literate show better mathematical connection skills compared to students who are tech-blind. This can be explained by several factors:

1. Familiarity with technology, meaning students who are used to the use of technology tend to adapt faster to applications such as Geogebra. They may find it easier to master the app's features and utilize them effectively to visualize and incorporate mathematical concepts.
2. More intense interactions, meaning that tech-savvy students may be more active in using the Geogebra application for exploration and experimentation. They may more often dig into the app's features and try different scenarios to test their understanding.
3. Higher intrinsic motivation, meaning the use of technology in mathematics learning can increase students' intrinsic motivation, especially when they feel involved in discovery-based learning. This

can motivate them to better understand mathematical concepts and look for relationships between these concepts.

The application of the Motiv-Learning model using the Geogebra application has important implications for the development of learning strategies in the classroom. This study found that it is necessary to habituate students who are tech-blind in order to maximize technology-based learning. Some of the implications that can be noted are:

1. The expansion of the use of technology, which means that schools and teachers need to increase access and use of technology in mathematics learning. This includes training for teachers and adequate facilities to support the use of apps like Geogebra.
2. Curriculum adjustment, which means that the mathematics curriculum can be adjusted to better integrate technology in learning. This will not only improve students' math connections, but also prepare them to face the demands of an increasingly technologically connected world.
3. Student skill development, which means that learning to use Geogebra can help develop student skills in terms of skills, especially geometry and problem-solving skills relevant to modern technology.

CONCLUSION

The conclusion of this study is that the use of the Motiv-Learning model with the Geogebra application is more optimal in influencing the mathematical connection ability of students who are classified as technologically literate. Students who are in the technology-blind group who are classified as high, medium, and low connection abilities need to increase their learning time at school and practice at home more often using the Geogebra application to hone their skills in utilizing technology in learning. For students who are in the technology literacy group that is classified as a category of low connection ability, it is necessary to practice more often at home using the Geogebra application to hone their skills in using the Geogebra application. By continuing to deepen this understanding, educators can develop more effective strategies in utilizing technology to improve students' overall math connection abilities.

SUGGESTIONS

Although the results of the study show the benefits of using Geogebra for tech-savvy students, there are several challenges and suggestions for further research:

1. Accessibility challenges, namely there are still challenges related to technology accessibility in various schools and regions. Further research can explore how to provide more equitable access to technology for all students.
2. Variations in the use of applications, i.e. further research can compare the effectiveness of various applications and other technological strategies in improving students' mathematical connection skills.

REFERENCE

[1] R. Hershkowitz, “Shape and Space: Geometry Teaching and Learning,” in Encyclopedia of Mathematics Education, Springer, 2020, pp. 774–779.
[2] N. Presmeg, “Visualization and learning in mathematics education,” Encycl. Math. Educ., pp. 900–904, 2020.
[3] S. M. Chiphambo and N. N. Feza, “Exploring Geometry Teaching Model: Polygon Pieces and Dictionary Tools for the Model.,” EURASIA J. Math. Sci. Technol. Educ., vol. 16, no. 9, 2020.
[4] S. Hegedus and L. Moreno-Armella, “Information and communication technology (ICT) affordances in mathematics education,” Encycl. Math. Educ., pp. 380–384, 2020.
[5] M. Arvanitaki and N. Zaranis, “The use of ICT in teaching geometry in primary school,” Educ. Inf. Technol., vol. 25, no. 6, pp. 5003–5016, 2020.
[6] A. Rienow et al., “Augmented reality and virtual reality applications based on satellite-borne and ISS-borne remote sensing data for school lessons.” Springer, 2020.
[7] M. Takac, “Application of web-based immersive virtual reality in mathematics education,” in 2020 21th International Carpathian Control Conference (ICCC), 2020, pp. 1–6.
[8] E. Demitriadou, K.-E. Stavroulia, and A. Lanitis, “Comparative evaluation of virtual and augmented reality for teaching mathematics in primary education,” Educ. Inf. Technol., vol. 25, no. 1, pp. 381–401, 2020.
[9] S. S. K. Mohd, S. Saleh, H. Zulnaidi, W. T. Yew, and S. A. M. Yatim, “Effects of brain-based teaching approach integrated with GeoGebra (bgeo module) on students’ conceptual understanding,” Int. J. Instr., vol. 15, no. 1, pp. 327–346, 2022.
[10] A. Fatahillah, I. D. Puspitasari, and S. Hussen, “The Development of Schoology Web-Based Learning

Media with GeoGebra to Improve the ICT Literacy on Quadratic Functions.," J. Res. Adv. Math. Educ., vol. 5, no. 3, pp. 304–316, 2020.
[11] J. Filgona, J. Sakiyo, D. M. Gwany, and A. U. Okoronka, "Motivation in learning," Asian J. Educ. Soc. Stud., vol. 10, no. 4, pp. 16–37, 2020.
[12] T. W. Malone and M. R. Lepper, "Making learning fun: A taxonomy of intrinsic motivations for learning," in Aptitude, learning, and instruction, Routledge, 2021, pp. 223–254.
[13] H. Alamri, V. Lowell, W. Watson, and S. L. Watson, "Using personalized learning as an instructional approach to motivate learners in online higher education: Learner self-determination and intrinsic motivation," J. Res. Technol. Educ., vol. 52, no. 3, pp. 322–352, 2020.
[14] A. K. Kenedi, D. Ramadhani, R. Fransyaigu, and B. Mulyahati, "Mathematical Connection Ability of Elementary School Students During the Covid-19 Pandemic," in 2nd International Conference on Science, Technology, and Modern Society (ICSTMS 2020), 2021, pp. 269–271.
[15] C. R. Nıeto, F. Rodríguez, and J. G. García, "Pre-service mathematics teachers' mathematical connections in the context of problem-solving about the derivative," Turkish J. Comput. Math. Educ., vol. 12, no. 1, pp. 202–220, 2021.
[16] J. García-García and C. Dolores-Flores, "Exploring pre-university students' mathematical connections when solving Calculus application problems," Int. J. Math. Educ. Sci. Technol., vol. 52, no. 6, pp. 912–936, 2021.
[17] K. Açıkgül, "Mathematics teachers' opinions about a GeoGebra-supported learning kit for teaching polygons," Int. J. Math. Educ. Sci. Technol., vol. 53, no. 9, pp. 2482–2503, 2022.
[18] M. Numai, C. Toopsuwan, and P. Duangpummet, "The Effects of Inductive and Deductive Learning Activities with Geogebra Application on Mathematical Connection Ability and Attitudes towards Mathematics in the Topic of Conic Sections of Matthayom Suksa 4 Students," in 1st International Conference On Education 2022 Committee, 2022, vol. 118, no. 1st, p. 117.
[19] A. Mardhiah, M. Ikhsan, and M. Subianto, "Mathematical Connection Ability through the Application of the AIR (Auditory Intellectualy Repetition) Learning Model Assisted by Geogebra Software," Int. J. Educ. Digit. Learn., vol. 1, no. 4, pp. 127–132, 2023.
[20] C. A. Mertler, "Quantitative Methodology in Adolescent Research," Encycl. Child Adolesc. Dev., pp. 1–14, 2020, doi: 10.1002/9781119171492.wecad313.
[21] J. W. Creswell, Penelitian kualitatif & desain riset. 2015.
[22] D. F. Mokodompit, R. J. Pulukadang, and O. Manurung, "Profil Kreativitas Siswa Kelas VIII SMP N 1 Kalawat Dalam Penyelesaian Masalah Geometri Ditinjau Dari Gaya Belajar Matematika," JSME (JURNAL SAINS, Mat. DAN EDUKASI) Mat. FMIPA UNIMA, vol. 8, no. 1, pp. 23–28, 2020.
[23] S. Radović, M. Radojičić, K. Veljković, and M. Marić, "Examining the effects of Geogebra applets on mathematics learning using interactive mathematics textbook," Interact. Learn. Environ., vol. 28, no. 1, pp. 32–49, 2020.
[24] J. M. H. Nenohai, O. E. Nubatonis, and D. D. Samo, "Developing Cultural Context Teaching Material of Geometry with GeoGebra to Increase Students' Higher-order Thinking Skill," in 1st International Conference on Mathematics and Mathematics Education (ICMMEd 2020), 2021, pp. 172–179.
[25] M. S. Uwurukundo, J. F. Maniraho, and M. Tusiime Rwibasira, "Effect of GeoGebra software on secondary school students' achievement in 3-D geometry," Educ. Inf. Technol., vol. 27, no. 4, pp. 5749–5765, 2022.
[26] H. A. El-Sabagh, "Adaptive e-learning environment based on learning styles and its impact on development students' engagement," Int. J. Educ. Technol. High. Educ., vol. 18, no. 1, p. 53, 2021.
[27] L. A. Dantas and A. Cunha, "An integrative debate on learning styles and the learning process," Soc. Sci. Humanit. Open, vol. 2, no. 1, p. 100017, 2020.
[28] S. F. Griffith, M. B. Hagan, P. Heymann, B. H. Heflin, and D. M. Bagner, "Apps as learning tools: A systematic review," Pediatrics, vol. 145, no. 1, 2020.
[29] G. Bozkurt and M. Y. Koyunkaya, "Supporting prospective mathematics teachers' planning and teaching technology-based tasks in the context of a practicum course," Teach. Teach. Educ., vol. 119, p. 103830, 2022.
[30] A. Perienen, "Frameworks for ICT integration in mathematics education-A teacher's perspective," Eurasia J. Math. Sci. Technol. Educ., vol. 16, no. 6, p. em1845, 2020.
[31] P. Appavoo, "The impact of a Technology-based approach for the learning of Mathematics at secondary school level," J. e-Learning Knowl. Soc., vol. 16, no. 4, pp. 76–85, 2020.
[32] S. Bai, K. F. Hew, and B. Huang, "Does gamification improve student learning outcome? Evidence from a meta-analysis and synthesis of qualitative data in educational contexts," Educ. Res. Rev., vol. 30, p. 100322, 2020.
[33] A. Wigfield, "The role of children's achievement values in the self-regulation of their learning

outcomes," in Self-regulation of learning and performance, Routledge, 2023, pp. 101–124.
[34] O. Birgin and H. Acar, "The effect of computer-supported collaborative learning using GeoGebra software on 11th grade students' mathematics achievement in exponential and logarithmic functions," Int. J. Math. Educ. Sci. Technol., vol. 53, no. 4, pp. 872–889, 2022.