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Development of Geogebra Assisted Learning Modules to Improve Mathematical Representation Abilities of Senior High School

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ABSTRACT

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This investigation's purpose is to evaluate the following: 1) Valid Geogebra-Assisted Learning Module. Validity testing found module prototype issues. Five validators averaged 4.15 module validity. Learning independence questionnaire (0.84), pre-test of mathematical representation ability (0.805), and post-test of mathematical problem solving (0.744) were reliable. Experts evaluated the Geogebra-Assisted Learning Module. Student response questionnaire score was good (82.44%) in Trial II. The geogebra-assisted learning module helps. The geogebra assisted learning module met students' mathematical representation criteria in trials I and II. classically, trial II indicated that (1) students' post-test mathematical representation ability was 78.33 higher than their pre-test score of 62.38; (2) the average student score was L Standards for Student Mathematical Representation Classically, trial II showed post-test mathematical representation ability of 78.33>62.38. In trial II, 85.71% of children met traditional student success norms with a minimum score of ≥ 70 in the mathematical representation ability test. Student math post-test results met classical standards. From the average percentage data of the student learning independence questionnaire before treatment of 65.51 and the average class of student learning independence after treatment of 80.09, the average score of students' mathematical learning independence after Geogebra-assisted learning was Geogebra-Assisted Learning Improves Math Representation N-Gain improved students' mathematical representation pre- and post-test. Average student mathematical representation N-gain was 0.45. Enhancing Student Learning Independence The N-Gain student learning independence questionnaire scores before and after treatment in trial I prove Geogebra-Assisted Learning Modules work. Geogebra-assisted learning increased "moderate" student independence by 0.42.

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A. INTRODUCTION

In formal education, mathematics is a subject taught at every level of education starting from elementary school, secondary school, to college. Cornelius (Abdurrahman, 2003) put forward five reasons for the need to learn mathematics, namely because mathematics is: 1) A means of thinking clearly and logically. 2) A means of solving everyday life problems. 3) A means of recognizing patterns of relationships and generalization of experiences. 4) A means of developing creativity. 5) A means of increasing awareness of cultural developments. Because mathematics is intricately related to everyday concerns, humans value it highly. Mathematical approaches inspire social and economic thinkers. Engineering disciplines are predicated on mathematical computations. Additionally, mathematical philosophers introduced color into music, architecture, and painting. Mathematics is instrumental in the success and failure of a nation in the realm of finance and economics, as the current free market economy necessitates the calculation and execution of all operations in a mathematical manner. Mathematics enables us to cultivate everything in accordance with our mentality. Consequently, mathematics is a critical component of nearly every aspect of life and contributes to human advancement.

However, the difficulty in Indonesia is that pupils continuously receive below-average mathematics scores on both the national and international levels. The results of the 2018 Program for International Student Assessment assessment demonstrate that Indonesian pupils are still doing poorly in mathematics. With a score of 379, Indonesia is ranked 75th out of 81 countries. China and Singapore hold the highest positions in comparison to scores of 591 and 569, respectively. This is, of course, a significant challenge for mathematics educators to develop engaging learning experiences that students will enjoy, despite the fact that mathematics lessons have traditionally been perceived as intimidating. Ultimately, this is consistent with the increase in mathematical learning achievement. In order to enhance their mathematical learning abilities, pupils must possess specific mathematical skills. The capacity to represent mathematical ideas is among the most important mathematical skills that pupils need to learn. The capacity to use mathematical symbols, equations, tables, and diagrams is referred to as mathematical representation ability, and drawings to communicate a mathematical concept, thereby resolving, elucidating, and communicating mathematical issues (Minarni, et al, 2020). Mathematical representation is also essential for resolving mathematical problems. Students will unquestionably experience substantial advantages when confronting mathematical challenges if they possess strong mathematical representation abilities.

Students can enhance their comprehension of mathematical topics and their relationships by constructing, comparing, and applying various mathematical representations. This explains why the process of learning mathematics places a high value on mathematical representation. Furthermore, by employing representational tools such as real objects, photos, graphs, diagrams, and symbols, students can better explain their concepts. The following mathematical representation indicators were employed in this study: 1) Using visuals to assist comprehend and solve problems; 2) Creating a model or mathematical expression from the situation; and 3) Using computation to solve problems requiring mathematical expressions. Empirical studies reveal that students' skill in mathematical representation remains weak. This is in line with what the researchers discovered after chatting with a math teacher at SMA Negeri 14 Medan. The approach began with the researchers asking the students about the information that they found difficult to explain to others. One of these materials, he continued, is distance in a plane. "Students were unable to interpret the questions I posed into mathematical language." They had trouble turning my question or problem into a picture. Naturally, this makes it more difficult for students to overcome the challenges they encounter. The researcher concluded, "In short, these children's representation abilities are still very low." As we are all aware, one of the requirements for students to meet in order to be considered proficient to represent mathematical ideas mathematically. Subsequently, the investigator classified the pupils' learning objectives. Students are divided into five groups based on how well they can represent mathematical ideas: high, medium, low, extremely low, and high.

Table 1. Type of mathematical representation capability

Score	Categories
$85 \leq x$	Very High
$70 \leq x < 85$	High
$55 \leq x < 70$	Medium
$40 \leq x < 55$	Low
$x < 40$	Very Low

Mathematical representation questions were given to 36 SMA Negeri 14 Medan class XII students on September 23, 2022. The outcome of the research indicated that 19 students who got together the criteria for the study outlined problems to assist in explanation and facilitation of the solution, which totaled 52.8%. In addition, 43.2% (17 participants) expressed the ability to develop mathematical expressions or models in response to provided problems. Meanwhile, indicators for conducting calculations to resolve challenges with mathematical expressions accounted for 38.9% (14 individuals). The test findings also showed that two people were categorized as extremely high, five as high, eight as medium, fourteen as low, and seven as low based on the students' aptitude for mathematical representation. This matches the researcher's interview with a SMA Negeri 14 Medan math teacher. The researcher first questioned what pupils found difficult and hard to teach. He mentioned flat-sided space distance material. My students can't translate my questions into math. They struggle to convert my questions into mathematical symbols and often cannot convey them in visuals. Naturally, this hinders pupil problem-solving. These kids' representation skills are still low ". While representing mathematics is a standard mathematical skill, students must have it. In the meantime, just sixteen people fulfilled the material's minimum completion requirement of 70.

This shows that just 44.4% of the participants received a score of 70, while 85% is the ideal proportion for classical completeness (Trianto, 2011). This evidence clearly demonstrates children's weak mathematical representation ability.The researcher asserts that it is critical to find exercises and resources for mathematics instruction that can improve students' capacity for mathematical representation, in light of the aforementioned facts and the current learning environment. Within this investigation, modules serve as instructional materials, while the Geogebra program serves as the medium. We selected this curriculum because students had previously exclusively utilized printed materials provided by the school. None of the mathematics instructors at SMA Negeri 14 Medan have independently developed modules. In addition, the module is self-instructional, which enables children to learn independently, as Prastowo (2015) has noted. The printed learning resource, the module, is organized in a systematic manner based on the age and level of language proficiency of the students, making it easy to comprehend. The teacher provides minimal assistance or guidance, allowing students to learn autonomously.

Argument The following definition of a module as a learning subject that learners can study independently is consistent with Perpurnas Pusdiklat's (2021) definition. It includes fundamental components and instructions that pupils can follow step-by-step without help from the instructor. This contrasts with the accompanying learning resources, which involve both in-person and virtual interactions between students and teachers. Typically, textbooks are used under a teacher's supervision. The GeoGebra program-supported module, i.e., one whose contents are integrated with GeoGebra-based problem-solving techniques, will be utilized in the upcoming research. Hohenwarter et al. (2008) claim that Geogebra is dynamic mathematics program combining geometry, algebra, and calculus. Wulandari (2015) claims that Geogebra is a user-friendly mathematical tool applicable for the study of algebra, geometry, and calculus. GeoGebra is a mathematical program designed to educate students algebra, geometry, and calculus, as was already mentioned. Geogebra provides students with a visual representation of abstract concepts, therefore facilitating more effective mathematical learning. Geogebra can also be used as a tool for interactive mathematics education to design learning opportunities allowing students to study several abstract mathematical concepts. GeoGebra was selected by the researchers as the study teachers had never used learning tools prior. Furthermore accessible as free software for several OS systems was GeoGebra. Geogebra supports more than 40 languages, 3D, and the posting of.ggb files to the web. For kids, this makes it easier because all they need is a browser to participate. Put otherwise, students are not need to install GeoGebra on their computers, but they do need to make sure that Java is the most recent version installed. Furthermore, operating it is simple. For every button and syntax, Geogebra provides usage and support instructions.

It is evident that students' representational abilities are essential in mathematical education, as evidenced by the aforementioned considerations. Nevertheless, the data collected indicates that the majority of students do not meet these two criteria, which implies that there are issues that must be resolved. In order to resolve this matter, researchers developed training materials that satisfied the standards of practicality, effectiveness, and validity. The research in this example will concentrate on developing geogebra-assisted learning modules to enhance high school students' mathematical representation skills since the teaching resources relate to this ability. Therefore, the aim of this work is to evaluate the validity and application of the suggested geogebra-assisted learning module as well as to improve mathematical representation capacity by means of the created geogebra-assisted learning modules.

B. RESEARCH METHODS

The methodology of this examination is based on developmental research. Through this research process, specific commodities are generated and their viability assessed. This inquiry made use of the ADDIE development approach. This project is to create a math learning module using geogebra that solves the distance in planar space concept. The research took place at SMA Negeri 14 Medan, on Jalan Siswa Ujung Gd. Darmo in Binjai Village, Medan Denai District, Medan Municipality, North Sumatra Province. The study took use of the odd semester between 2023 and 2024 in the school year. The research subjects for the academic year 2023–2024 were students registered in SMA Negeri 14 Medan in class XII. This research centers on a learning module using mathematics. The present work develops learning modules applying the ADDIE development model. Analysis, design, development, implementation, and evaluation make up the five phases or stages of this process.

(a) Analysis Stage

At this point, researchers evaluate the need for learning modules together with their practicality and development requirements. The first phase of the ADDIE development research model, according to Rusmayana (2021), is evaluating the need for new commodities (models, techniques, media, and instructional materials) together with their feasibility and prerequisites. A fault in a current or implemented product could inspire the design of a new one. Regarding target objectives, learning environments, technology, student traits, and other elements, current or past objects could be out of current and cause problematic situations. Consequently, the researcher carried out an analysis for this study comprising an investigation of the curriculum, learning goals, student personality, and student needs.

(b) Design Stage

Winaryati et al. (2021) define design activities as the following: The steps involved in the design stage are as follows: a) gathering all data From the analysis stage, the creative process of product design commences; b) the materials and resources that will be necessary are identified, developing activities, and choosing the best method of assessment; and c) creating a storyboard or blueprint as the final product of the design stage. During this phase, the researcher followed Winaryati et al. (2021)'s design activities in three steps: (1) development and evaluation of the tool; (2) selection of media that is consistent with the subject matter and learning objectives; and (3) determination of the format, which involves examining the current forms of teaching materials and determining the organization of the new one. During this phase, a prototype version of the three-meeting learning implementation plan (RPP), as well as learning modules, activity sheets, learning surveys that are controlled by the students, substitute answers, and evaluation standards, are developed. Furthermore, the mathematical representation capabilities of students are evaluated. Document I is the term employed to refer to all results during this design phase.

(c) Development stage

A prototype I design for a learning module is generated through the analysis and design phases. The initial phase of the development procedure entails conducting field testing after the draft I has been validated by specialists. The primary focus of expert validation was the format, content, images, and language of the learning modules and tools that were developed. In response to expert validation results, which encompass AI ratings, revisions, criticism, and suggestions, Draft I is modified and enhanced. The revision resulted in the development of learning modules that satisfied the fundamental criteria and included geogebra assistance. These modules will be referred to as draft II from this point forward. Expert validation informs the revision and improvement of modules and tools.

(d) Implementation Stage

During the first experiment, which takes place at the study site, SMA Negeri 14 Medan, the learning tools from draft II are tested, the validity requirements are satisfied. According to the RPP, which was created to determine the applicability and effectiveness of the learning modules that were being constructed, Class XII IPA 1 held three sessions to conduct Trial I. Table 2 also shows the trial design of the One-Group Pretest-Posttest Design that was utilized in this investigation. (Sugiyono, 2013).

Table 2. One-Group Pretest-Posttest Design

Pretest	Treatment	Posttest
O_1	X	O_2

The instruments utilized in this investigation comprised an evaluation of students' mathematical representation abilities, instructor response surveys, and student response questionnaires. Data processing that utilizes descriptive statistical analysis to provide study results is based on the modules' mean score, which has been examined and updated by mathematics education specialists according to their corrections and recommendations. The findings of this validation will enable us to determine whether the research instruments and learning modules are prepared for use or necessitate revisions. The values are acquired and inserted into the corresponding table column after processing. Furthermore, as demonstrated This total value is within the acceptable range for determining the level of module validity, as shown in Table 3.

Table 3. Validity Level Criteria

Number	V_a	Criteria
1	$1 \leq Va < 2$	Invalid
2	$2 \leq Va < 3$	Less Valid
3	$3 \leq Va < 4$	Quite Valid
4	$4 \leq Va < 5$	Valid
5	$Va = 5$	Very Valid

When the minimal level of validity achieved is the valid level, research instruments and modules that utilize geogebra are considered to have a moderate level of validity according to the criteria. Revision is required if the degree of validity attained falls short of being valid. Then, the validation processes are run through again. Ultimately, the validity measure reveals the optimal module. At least one satisfactory response from each student is required for the Geogebra-assisted learning module to be deemed practical. Additionally, the learning tool implementation sheet in class must have an average score that is at least satisfactory. Lastly, evaluations of learning tools created by experts or practitioners must demonstrate that they can be used with minimal revision.

When the expected implementation time is met, students show learning mastery in at least 85 percent of cases, the student self-regulated learning questionnaire scores in the "medium" range (55<SKBS≤70), and students' mathematical representation ability scores in the minimum range of 70 percent, then geogebra-assisted learning modules are deemed effective.

After implementing the Geogebra-assisted learning module, the N-Gain formula is used to determine the growth in students' ability for mathematical representation and self-regulated learning. Hake (1999) states that the N-Gain formula is one test that can provide a comprehensive understanding of the increase in learning outcome scores prior to and after a therapy is applied. Here is Hake's (1999) N-gain formula:

$$N - gain = \frac{S_{post} - S_{pre}}{S_{max} - S_{min}}$$

Information:

$N - gain$: N-gain score
S_{post} : posttest score
S_{pre} : pretest score
S_{max} : maximum score
S_{min} : minimum score

Table 4. N-Gain Score Criteria

Gain Score	Interpretation
$g > 0.7$	High
$0,3 < g \leq 0.7$	Medium
$g \leq 0.3$	Low

C. RESULT AND DISCUSSION

During the analysis phase, researchers determined whether learning modules were necessary, how feasible they would be, and what was necessary to construct them. The need for new goods (models, techniques, media, instructional materials) and the feasibility and requirements for product creation are assessed in the first step of the ADDIE development research model (Rusmayana, 2020). In certain cases, a problem with an existing product can inspire the creation of an entirely new one. Issues may arise when existing goods do not meet the requirements of specific learning contexts, technological capabilities, student traits, etc. Consequently, the researcher analyzed various aspects pertaining to the examination of student needs. Examining the classroom setting as a whole and the difficulties educators encountered in trying to devise new, more effective methods of instruction were both part of this process. In order to find out how the class feels about math and what they've learned in math, the researcher also looked at student behavior.

Examined learning conditions are the main source of information used in the study of student needs. Also examined are the difficulties instructors encounter when coming up with workable substitutes for class activities that are more productive and efficient. In order to identify fundamental challenges, this investigation implemented classroom observations and interviews. At this level, alternative solutions and facts are presented, which facilitates the identification of the initial stages in the development of solutions that satisfy the students' needs. The primary focus of learning is still on the teacher, as indicated by the observations of the researchers. Information is still conveyed through lectures, question-and-answer sessions, and assignment distribution, which are all part of the conventional learning approach. Students exhibit a minimal degree of student learning autonomy, as they solely listen to the teacher's explanations, follow instructions, and ask the teacher example questions. Numerous children were unable to transcribe inquiries into images or compose mathematical equations when they were tasked with resolving challenges. Instructors had never built modules independently, according to the interviews, and students only had textbooks to rely on, according to the observations. In interviews with students, it was discovered that they were disinterested and rarely read books at home or before classes began. When researchers looked into the reason, some students said that the images in the book made the content less engaging, while others said that the material's methods or directions weren't always clear. There is also a significant amount of content that needs to be reviewed with the teacher or while waiting for an explanation.

The assessment of the academic ability of SMA Negeri 14 Medan pupils who are classified as low achievers is the first step in the student analysis outcomes. Researchers who conducted interviews with study teachers discovered that students were having problems. understanding the separation in a planar area between materials. Students often misinterpret the questions that are posed. "Students are unable to translate the questions I pose into mathematical terms." Enita Napitupulu, S. Pd., a math instructor at SMA Negeri 14 Medan, noted in an interview with researchers that her students "find it extremely challenging to convert problems or questions from me into mathematical symbols mathematically, and many are unable to express them in the form of pictures."

The researcher observed that 2 individuals scored very high, 5 individuals scored high, 8 individuals scored medium, 14 individuals scored low, and 7 individuals scored very low. In the meantime, just 16 people met the minimal completion criterion of 70 for this material. These findings indicate that only 44.4% of the participants achieved a score of 70, whereas the optimal proportion for classical completeness is 85% (Trianto, 2011). These statistics clearly indicate the ongoing insufficiency of students' mathematical representation skills.

Additionally, pupils at SMA Negeri 14 Medan continue to exhibit a deplorable lack of learning independence. This is consistent with the researchers' findings, which showed that most learning is still focused on the teacher. Learning is still essentially the process of disseminating knowledge via traditional teaching techniques including lectures, homework, and Q&A sessions. As they only pay attention to the teacher's explanations, follow instructions, ask the teacher example questions.

Examining the features of the updated 2013 curriculum that the school adopted allowed for a curriculum analysis. This is done to ensure that learning modules are developed in accordance with curricular standards. Subsequently, researchers investigated Basic Competencies (KD) to establish learning achievement markers. It is also advantageous to establish learning objectives in order to provide more explicit indications of the attainment of learning outcomes. Fundamental competencies (KD) and curriculum indicators associated with a material concept are employed to establish learning objectives or indicators that facilitate the attainment of learning outcomes.

Tabel 5. Learning Objectives: Distance in Flat Space

Number	Topic	Learning objectives	Meeting
1	The distance in level space between two points.	1. Students are capable of accurately describing the distance between objects in space.	1
		2. Students are capable of accurately articulating the process for calculating point-to-point distances.	
		3. Students accurately ascertain the distance between two points in a planar space.	
2	The distance between a point and a line in flat space	1. Students are capable of accurately describing the distance between objects and lines in space.	2
		2. Students are capable of accurately articulating the process for calculating Distance between a point and a line.	
		3. Pupils measure a point's distance from a line in planar space properly.	
3	The separation in flat space between a point and a plane	1. Students are capable of accurately describing the Distance between a point and a plane in space.	3
		2. Students can clearly describe how to find how far apart two points are from a horizontal plane.	
		3. In planar space, students correctly determine the distance between two points.	

During the design phase, a preliminary draft was created to test the mathematical representations of students, create learning modules, lesson plans, worksheets, questionnaires for self-regulated learning, observation sheets for learning implementation, and polls for students to fill out. Winaryati et al. (2021) say that design tasks include: a) collecting data from analysis and beginning the design process for the product, b) figuring out what resources and materials will be needed, creating activities, and choosing the right evaluation method; and c) creating a storyboard or blueprint as the end result of the design stage. During the design phase, the researcher followed the methodology of Winaryati et al. (2021) and implemented three procedures: (3) choosing the format, which entails researching current instructional material forms and deciding on the format for new instructional materials; (1) developing and evaluating the instrument; (2) choosing media that matches the material's attributes and learning goals; and (3) choosing the format.

Used indicators of learning independence and mathematical representation ability to come up with. The assessments are intended to be applicable to the cognitive abilities of the students. The evaluation guide, which comprises answer keys and scoring standards for each exam item, is employed to evaluate exam results. Furthermore, a validation document is generated to facilitate the validator's evaluation of the instruments that have been generated. At this point, we create an RPP for three meetings, learning modules, activity sheets, exams of students' mathematical representation ability, questionnaires about students' learning independence, possible answers, and criteria for scoring. Draft I refers to all results obtained during this design stage.

Carrying out field testing and validating draft I with specialists are the earliest stages of the development process. During expert validation, the created learning modules and tools were mainly evaluated for their organization, topic matter, language, and visuals. Results from expert validation, which include AI ratings, mistakes, criticism, and suggestions, are used to make revisions and improvements to the initial document. Learning modules that met the basic requirements and had a geogebra assist were created as a result of the change. From now on, these modules shall be called draft II. The outcomes of expert validation serve as a roadmap for the improvement and updating of modules and tools. Expert validation, which gave the learning program an average score of 4.15, showed that it was valid.

The second step is the implementation phase, where the learning modules and instruments in draft II form are tested at the study site, SMA Negeri 14 Medan (henceforth called trial I). This happens after the learning modules and instruments have met the validity criteria. The first test was held in a school. The trial I average for all of the students who said "yes" to the "good" question was 87.43%. But the trial I did to see how well the built-in learning tool worked for learning was marked as "not good" because it got an average score of 2.96. There were success criteria for the use of learning media in the context of implementing learning that were not met by this result. It might not be practical yet because it doesn't meet one of the requirements for being useful: the use of educational tools in the classroom hasn't hit the lowest level that's acceptable yet.

Then, Trial II was put into practice, and the learning module with Geogebra support was improved. Trial II received a "good" rating because, on average, 90.29% of all student responses were positive. The learning module created in trial I was used to implement learning, and the average score fell into the "executed well" category. A score of 3.84 indicates "Good".

On the pre-test, 28.57% of students were good at traditional learning, and on the post-test, 85.71% were good. The posttest results for students' mathematical representation skills in trial II met the standards for classical completeness, which says that at least 85% of students who are actively learning must get a score of 70 (complete). It also fits with the required learning period when it comes to learning time. Because it meets all of the factors for effectiveness, it is possible to say that this Geogebra-assisted learning module works. The next step is to use the N-Gain number to look at data about how students' mathematical representation skills and ability to self-regulate their learning have improved. The average N-gain for mathematical representation ability was 0.45 ($0.30 < 0.45 \leqq 0.7$), which means it went up in the "medium" range. The kids got an average N-Gain score of 0.42 for self-regulated learning, which means they got better in the "medium" category. ($0.30 < 0.42 < 0.70$).

Based on the above description, we can say that the suggested geogebra-assisted learning module meets the criteria for being useful, successful, and realistic. It will also help students get better at representing math. Several things affect the acquisition of a true learning module, such as: To begin, the learning module that was made meets the criteria for topic validity. This means that the Geogebra-assisted learning program was made using the standards that were already in place for the curriculum. These standards for the curriculum deal with the basic and necessary skills that students must develop via lesson plans or subject-specific learning activities. According to Arikunto (2012), if a learning tool can assess precise, focused objectives linked to the subject matter or lesson material, it has great content validity. This claim is backed up by the ones already discussed. Content validity and curriculum validity are often used interchangeably.

Second, it was shown that the learning module's construct validity. This suggests that the principles and Signs of how well you can describe math, along with Self-regulated learning by students, were utilized in the development of the Geogebra-assisted learning module, which was then combined with problem-based learning. In order to assess students' mathematical proficiency and self-regulated learning, a module has been developed to supplement It's easy to learn by solving problems with the RPP and Worksheets. in addition, the discovery of shortcomings in the trial I implementation served as a foundation for researchers to improve the learning module in order to meet realistic and efficient criteria.

Furthermore, the findings of the study " How well students in the mathematics education study program can represent numbers mathematically" conducted by Ratumanan et al. in 2022 suggest that there are two main reasons why students have inadequate mathematical representation ability: (1) Mathematics learning and (2) comparatively low prior knowledge. Educators regulate this; pupils are not afforded the opportunity to hone their mathematical representation abilities during their academic careers. Consequently, the learning process is no longer monopolized by teachers, as students have the option to learn independently or with the assistance of a teacher, thanks to the implementation of Geogebra-assisted learning modules. Additionally, the module provides students with detailed instructions for utilizing the GeoGebra application, enabling them to develop their mathematical representation skills and engage in group discussions.

The researchers observed that as the learning activities advanced, pupils' capacity for self-regulated learning grew. It is encouraged of the students to research the topic matter of the learning module. Furthermore, the facilitator function of the teacher rather than the explanation role of the teacher in traditional learning gives the idea that the modules are weapons that students need to become proficient in order to participate in learning activities. The fact that the two classes involved in the study had never used the GeoGebra application before is another reason why it appeals to kids. Additionally, when kids use technology to solve problems for themselves, they feel valuable. There was an increase in student self-regulation, according to test Get the student's N-Gain number on the Self-regulated learning questionnaire before and after therapy. The average score on the N-Gain test for student self-regulated learning was 0.42, which is considered "medium."

There are numerous deficiencies and faults in this study, which are the result of a variety of inescapable constraints, such as: 1) Teachers encounter difficulties in delivering equitable instruction to students. 2. The study's learning module is specifically made to test skills and Using mathematical representation skills on distance learning materials in flat plane shapes; it cannot, therefore, evaluate other higher order cognitive skills, like reasoning, critical thinking, creativity, and so forth. This is because the pupils are not experienced with group projects and the Geogebra application.

D. CONCLUSION AND SUGGESTIONS

The discussion and research in this study have led to a number of conclusions, which are listed below:

1. The conditions needed are met by the program that uses geometry to help with learning.
2. The program for studying with geogebra assistance meets practical requirements.
3. The learning module with geogebra assistance satisfies the efficacy standards.
4. The created geogebra-assisted learning module now has a better mathematical representation, as evidenced by an N-gain value of 0.45 indicating "medium" performance.

Meanwhile, here are some suggestions obtained from this study, namely it is suggested to other researchers who want to conduct research on measuring mathematical representation ability and students' learning independence to pay more attention to each indicator of these abilities in order to improve understanding of students' representation ability and learning independence. In particular, increasing N-Gain through the use of mathematical representation indicators to provide a more comprehensive analysis.

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