Improvement of Learning Model on Discovery Learning Assisted (PB-DLGA) by Geogebra Applet to Enhance the Creative Thinking Ability of the Students

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Abstract. This study is development research. The Improvement of Learning Model on Discovery Learning Assisted by Geogebra Applets (next called PB-DLGA) was setted out followed by the development stages of the result of the improvement from the model offered by Plump. It was conducted at Junior High School 1 Kutapanjang (SMP 1 Kutapanjang) in Gayo Lues, Aceh Province, Indonesia. The subject of this research were 25 students from VII graders. It used lesson plans, digital moduls, and creative thinking ability test (TKBK) as the tools during the research and gave the results as follows: 1) The discovery learning model assisted by the geogebra applet that was developed had met the rasionality (validity), feasibility (practicality), and efficacy (effectiveness) criteria in terms of their respective criteria; 2) There is an improvement in students' creative thinking skills using a discovery learning model with the help of the GeoGebra applet which was developed in the first trial, obtaining an average preetest 57.12 and a posttest 74.72 and increased in the second trial with an average score 74.72: preetest 52.6 and posttest score 80.4. Based on the results, it is suggested that the use of Learning Model on Discovery Learning Assisted by Geogebra Applets (PB-DLGA) should be expanded in Mathemathics classes to improve students' creative thinking skills.

Keywords: improvement of learning, PB-DLGA, discovery learning assisted by geogebra applet, creative thinking ability

1 Introduction

Unusual learning activities happened in new normal era after pandemic covid-19 arose. Face-to-face learning activities were restricted everywhere to decrease the virus's transmission. Through A Letter Number 4 Year 2020 regarding the Implementation of Education Policies in an Emergency Period

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for the Spread of Corona Virus Disease, the minister of Education, Culture, Research, and Technology issued instructions. It told some main points. One of those is the learning activity should be done from home through online learning activities or distance learning. It should be done to give meaningful learning experiences for the students without any demands to finish the curriculum include the grade promotion or graduation.

In normal situation, we are used to conduct face-to-face learning activities. During the pandemic era, we had to conduct online or distance learning. live chat, WAG, state television channel (TVRI), etc. In fact, many teachers had not be able to use digital tools to help the learning process. Meanwhile teachers are ordered to make learning innovation and creativity. They are also demanded to adapt learning activities regarding to the process, skill, and the aesthetic of presentation during its process as mentioned by Dewi in her research (2020). Hence it is needed to make an innovation using a learning model.

There are many learning models which can be used to form scientific and social behaviors and improve students' curiosity. One of those is discovery learning model. Riadi (2017) says that discovery learning model is a learning process which happens when the students were given indirect information.

The students are demanded to organize their comprehension about any information by themselves. They are also trained to be a scientist. While Primary Education Section of Ministry of Education, Culture, Research and Technology (2020) mentions that learning through sharing is a form of discovery finding process which started by understanding concept, meaning, and relation through intuitive process to make a conclusion. *Discovery* happens if the students are involved in mental process so they can find some concepts and principal. Observation, classification, measurement, prediction, determination, and inference were used to carry out these tasks.

Meanwhile, Mukaramah (2020) tells that there are some lacks of discovery learning and it creates new assumption. Discovery learning gives difficulties for those who have academic barriers. It can be seen that they will get difficulties to relate relationship between written and oral concepts and make them were frustrated. Furthermore, this model is not efficient enough to be given in large classes with any students because it needs much time to help them finding the theory or coping the problems. That is why this learning model need to be advanced so the model can be used to improve students' ability.

One of the efforts to advance discovery learning is by using ICT (*Information and Communication Technology*) in mathematics learning process. Actually, the use of ICT is one of six principles in mathematics learning as mentioned by NCTM (2000). It claims that technology is crucial to both the teaching and learning of mathematics since it affects the subject matter taught and improves student learning.

Additionally, the contemporary process of model building that incorporates ICT is inextricably linked. GeoGebra is a well-known ICT tool or feature for math education. According to Hohenwarter and Fuchs (2004), a new program called GeoGebra combines dynamic and interactive algebra and geometry instruction into a single tool. The software of GeoGebra can be downloaded in www.geogebra.org site and can be run and copied freely. It means that GeoGebra is a free and

dynamic mathematics application program which can support mathematics learning process in school.

Furthermore, Priatna et al (2019) has created a discovery learning paradigm with assistance from GeoGebra to raise the level of professionalism among math teachers. They say that discovery learning model assisted by GeoGebra is a learning model which involves the students actively and optimally. Besides, it makes the students investigate the problems, improves problem solving ability which integrates creative thinking ability and understands the concepts. In fact, the use of GeoGebra in mathematics learning is still low. It is better to use it maximally to attract the students so they are interested in learning process.

Making digital modules for learning materials using the GeoGebra application is the first step in this exercise. The GeoGebra file is next submitted to the site and integrated into the activities that are scheduled. They are known as applets. According to Jane-jane Lo and Nina White (2020), the GeoGebra applet refers to an interactive online page that can be run straight from the GeoGebra website without being downloaded. Furthermore, this applet makes it simpler for teachers to keep an eye on their pupils' actions. They can ask pupils directly if they completed their assignments. It is suitable for the condition during the post pandemic era recently. In line with this view, according to Nafisa et al. (2019), the multimedia-assisted discovery learning model was capable of generating the students' activities throughout the learning process, allowing the students to keep working until they met the learning objectives.

The importance of developing of Discovery Learning Model Assisted by the GeoGebra Applet (PB-DLGA) can be explained that the learning model is one of the important components in learning process. Effective learning will require a learning model which is in line with the learning materials. If the learning model is appropriate then the implementation will be carried out effectively. Using the developed PB-DLGA will be more effective in helping the learning process to achieve the learnings aims. Based on the previous explanations of the issues, it is required to construct or enhance the discovery-based learning model with the help of the GeoGebra Applet in order to be able to address students' capacity for original thought. Additionally, teachers can employ the paradigm in the teaching of mathematics. Therefore, the researcher developed a model entitled *"Improvement of Learning Model on Discovery Learning Assisted by Geogebra Applets (PD-DLGA) to Enhance the Creative Thinking Ability of the Students".*

2 Methods of The Research

Developmental research is being conducted here. It creates the essential tools, models, and learning resources. Richey and Nelson (1996) assert that development research is focused on the creation of new products, describing the development process as accurately as possible and rating the results. The improvement or development of the PB-DLGA uses the modification of Plomp model by combining the stages of material (product) development by Nieveen which emphasizing three aspects of quality (rationality (validity), feasibility (practicality), and efficacy (effectiveness)). The stages include earlier investigation, planning, realization, testing, evaluation, and revision. This is

done because the Plomp model was considered too general to be applied in development of learning model. To measure the feasibility (practicality) and efficacy (effectiveness) of the PB-DLGA model, the required learning tools and instruments were developed. The product of this research is a valid, feasible, and effective Discovery Learning Model assisted by GeoGebra applets with the tools (lesson plans, digital modules, and a test of creative thinking) and required research instruments for the development or improvement of this model.

This research is conducted in State Junior High School 1 Kutapanjang, Regency of Gayo Lues, Aceh, Indonesia. Students from Classes VII-1 and VII-2, a total of 25 students, served as the study's subjects. It was conducted in the second semester in academic year of 2021/ 2022.

1.1. Data Analysis

a. Data analysis of Rationality (validity) of the PB-DLGA Model and Learning Tools

Researchers used descriptive statistical analysis based on the average score of each learning model, which was confirmed by experts in the field of mathematics education and amended in response to their corrections and suggestions, to determine the validity (rationality) of this learning model.

b. Data analysis of Feasibility (Practicality) of Learning Tools

Based on the findings of evaluations from several experts and practitioners, the viability (practicality) of the PB-DLGA model is determined (junior high school mathematics teachers). Experts and math teachers are chosen according to their knowledge of the ideas and their backgrounds. By taking into account the offered model and learning tool components, they must state whether or not the PB-DLGA may be applied. Next, the average value is calculated from the two. Its method makes use of offered learning resources known as intended-operational (IO) tools, and the tool employed is a sheet of observations on the use of a developed/improved model.

c. *Data Analysis of Learning tool Efficacy*

The criteria for judging the efficacy of a learning model are based on five indicators, namely: (1) the achievement of learning completeness if 85 percent of students who attend creative thinking ability get 75; (2) the achievement of learning goal completion (at least 75 percent of planned learning completion can be attained by at least 65 percent students); (3) students and teachers' activities; and (4) The management of learning by teachers; (5) Student and teacher responses to the elements of the learning model.

1.2. Instruments and Technigues of Data Collection

a. Instruments of Rationality (Validity) Assesment
b. Instrument of learning tools validation is learning tools validation sheets that used to get data about learning tools quality based on the assestments from the experts. These validation sheets includes the components of PB-DLGA model, lesson plans, digital modules, and creative thinking ability tests.
c. Instruments of Feasibility (Practicality) Assesment
   A development product is a product that has some criteria, that are (1) the experts and teachers notice that the improved learning model can be used, (2) the assesments sheets on

the implementation of discovery learning model assisted by GeoGebra applets (PB-DLGA) shows the good result.

d. Instruments of Efficacy (Effectiveness) Assesment
   The instrument for evaluating the effectiveness of the learning model consists of a test of creative thinking skills to determine the attainment of fundamental competencies, observation sheets for teacher and student activities, learning management observation sheets, and questionnaires with responses from teachers and students.

1.3. Development of Model, Tools, and Instruments

The improvement of learning Model based on Discovery Learning assisted by GeoGebra Applet (PB-DLGA) is done by following some phases of development as the result of a modification of Plomp model that emphasize on three aspects of Nieveen product.

a. Initial Research Phase

Considering the findings of previous observations made at the research site's school, it shown that mathematics learning process in State Junior High School 1 Kutapanjang has some lacks, both teacher and students. It can be seen that teacher only used the simple model which easier for her without considering students interaction with teacher and their friends. She hasn't used various and suitable learning models. It made the students were less enthusiastic. On the other hand, in the post-pandemic age, instructors are now obliged to be competent to apply ICT-based learning techniques. The initial study of the PB-DLGA model began with the question of ICT integration in learning models that have not been used; one such ICT integration is GeoGebra Apllet. At this point, work is being done to gather data on past or present problems with math learning and to formulate logical ideas on how to improve the PG-DLGA model. The next step is to categorize and research the ideas that have influenced the PB-DLGA model's development, especially those that support the discovery learning model's compatibility with learning models for mathematics.

In this stage, researcher analyzed the quality of used common learning tools which applied by mathematics teacher in the researched school, especially about the possibilities to improve learning tools which are assisted by GeoGebra applet. To do these step, pre-surveys and trials were needed. The next is to investigate theories of education tools improvement.

b. The Planning Phase

At this point, researchers developed a paradigm for teaching mathematics that relies on discovery learning using GeoGebra Applets (PB-DLGA). This stage's efforts included learning about future research and establishing the ideas underlying the PB-DLGA model's construction and content, building the learning model's component parts based on those theories, and selecting the format for the modeling book.

Researcher planned the learning tools which were suitable with the design of PB-DLGA model in this phase. The existing learning tools (the students and teacher hand books of 2013 Curriculum were sufficient to be used in learning process. Therefore, the researcher designed

lesson plans, digital modules, and creative thinking ability test. The lesson plans were made based on the designs and syntaxes of the PB-DLGA model.

c. *Realization*

This 3rd stage produced the early prototype draft of the PB-DLGA model as the result of the designing realization. Learning model is realized in the form of a modelling book. The main of its component consisted of Chapter 1 as Introduction of PB-DLGA model, Chapter II as Theoretical Review of PB-DLGA, Chapter III as Characteristics and components of PB-DLGA model, and Chapter IV as Conclusion

This stage produced learning tools included lesson plans, digital modules and the Test of Creative Thinking.

d. Testing, Evaluating, and Revising stage

The research was divided into four main activities: (1) conducting field trials; (2) validating the PB-DLGA model's activities and all associated learning; (3) asking experts and practitioners to evaluate the implementation and effectiveness of the learning model based on their theoretical mastery and experiences; and (4) conducting feasibility tests of all instruments used by some experts and practitioners. Testing, evaluating, and modifying the learning model using all of its learning tools were done in order during the four tasks.

3 Research Results

3.1 Result of designing learning model based on discovery learning assisted by GeoGebra Applet (PB-DLGA)

a. Syntaxes

Table 1. Syntaxes learning model based on discovery learning assisted by GeoGebra applet (PB-DLGA)

Steps	Activities
Stimulus of Creative Thinking	In this step, teacher asked students to undesrtand the basic concepts so that they have an idea about the learning material that will be studied. These activities are asking some questions, reading related books and other learning process which leads to creative thinking. This stimulation is used to give interactive situation that help students to be more active in exploring the materials. In this step, teacher used GeoGebra application.
Identifyng and Formulating Problems	Teacher gave the chance for students to identify some problems. Most of them chose the most interesting and flexibel to be solved. The chosen problem must then be formulated in the form of questions and or statements as the temprary answers of previous question asked. These activities aim to improve students' analitycal skill.
Designing and Planning	In this step, teacher designed and planed the procedures or steps of experiments using Geogebra applet. This step helps the students knew

	what to do with GeoGebra applet then they knew how to get and open the given link.
Experimenting Using GeoGebra Applet	To answer the questions or proving whether true or false of this hypothesis, teacher gives the students opportunities to make experiments, observing the objects, doing own trials using GeoGebra apllet etc. They then tried provided digital modules asstisted by GeoGebra applet.
Analysing	This step is aimed to improve students' analytical skill by answering the given questions in the experiments using GeoGebra. By using it, teacher knew the results of students' works. Then, the data that has been obtained can be analyzed using descriptive analysis methods. After that, summary of the results is obtained and it will be interpreted.
Presenting the results.	This activity aims to give the opportunites for students to do meticlous activity of their results. These activities were done by presenting and re-explaining about what they got through GeoGebra applet. When students hearing the ideas and explanation from others, they got better comprehension. It can also be used as indicator how far students comprehend their own concepts and ideas. In this phase, teacher guide the students about the process how to do the tasks using GeoGebra applet. Teacher then responded the students' results
Conclusion	After exploring the concepts from each previous steps, students and teacher made the final conclusions and gave some exercises related to critical thinking ability. This principle aims to invite students make conclusion together. It can be used as general principle by considering the results presentation.

b. Social System Design

The design of a social system or learning environment is a situation or atmosphere and norms that apply in a model based on discovery learning assisted by GeoGebra applets (PB-DLGA). It emphasize on teacher's role and activities that students must perform during the learning process following the patterns and rules in interaction's patterns and social contributions.

Students used computers that were connected to the internet during this learning process. Students must be able to use a computer independently and at the very least understand how the mouse and keyboard work.

c. Design of Reaction Principle

The design of management reaction principle is to give teachers an idea how to accommodate all students learning activities and how to perceive and respond to each behavior shown by students during the learning. In development or improvement of PB-DLGA model, teacher guide students in discovering. From this, it can be concluded that teacher's role in learning process as follows: 1) As a motivator, a teacher must inspire students to think critically and work diligently so that they can learn well; 2) As a facilitator, a teacher must provide the learning resources students need to complete their research; 3) As a learning manager, a teacher must oversee the relationship between students and the lesson plans that will be used, such as in pairs, group discussions, or individual

learning; and 4) As a consultant, a teacher must provide advice to students on how to improve their learning. For instance, when the mouse and keyboard need to be operationalized.
Teacher will go around observing the students and gives them opportunities to ask questions. Therefore, teacher guides, manages, and motivates the students when needed.

d. Support System Design

The design of support system is requirements or conditions needed to be able to apply a learning model based on discovery learning assisted by GeoGebra applets (PB-DLGA) designed such as classroom settings, learning tools, learning facilities, and media needed in learning. The support system needed in this model is digital modules using GeoGebra applets. Modules are arranged as learning materials and independent worksheet for students. Modules is used to guide students in improving creative thinking process. This model needs a computer laboratory or mobile phones.

e. Instructional Impacts and Additional Impacts

A learning model based on discovery learning assisted by GeoGebra applets is developed to gain the instructional and additional impacts as follows:

1. Students become actively involved in learning. They are trained to explore the information through the data obtained.
2. Students learn to discover concrete and abstract situation in each process.
3. Students strengthen their teamwork and information-sharing skills, which expands their capacity for creative thought.
4. By teaching students how to ask questions to get relevant data for assembling the findings, students can develop their capacity to think creatively.

Additionally, the model's extra effects include:

1. Teachers are eager to implement creative learning to encourage pupils to think creatively all the time.
2. In certain cases, skills acquired in discovery scenarios are more easily transferrable to new learning activities and circumstances.
3. Teachers are encouraged to use ICT to provide dynamic and varied learning.

3.2 Validation Results of learning model based on discovery learning assisted by GeoGebra applets (PB-DLGA)

Based on the previously mentioned research findings, it has been demonstrated that the GeoGebra applet-assisted discovery learning paradigm has good degree of validity. This model's validity was examined by fib experts. They observe impacts on syntax, the social system, the reaction principle, the support system, the educational system, and other factors.

Lesson plans with indicators, learning objectives, time allotment, materials, and learning activities are among the elements shown in this paradigm. Then, digital modules comprise material that is competent, high-quality, and appropriate for the PB-DLGA model. Tests of creative thinking capacity should reveal whether the applicant can think clearly, flexibly, creatively, and in detail. This constructed learning model has met the requirements for validity, according to the results of the expert validation. This finding is consistent with Nieveen's (1999) assertions that reliable components must be based on reliable material and that all components must be reliably connected to one another (construct validity).

Additionally, the validation of the lesson plans yielded 4.6 of the valid categories as the total average validation value from the aspects of developing indicators. The total average of validity from the competence aspect for the modules' validation results is 4.27 valid categories.

And the content category received a valid category as a result of the creative thinking ability test results. This indicates that the test is appropriate for the learning objectives and measurement indicators. The validation results for the test of creative thinking capacity, meantime, show that it can be understood sufficiently and only requires modest change. It is stated in the experts' suggestions.

The modelling book, lesson plans, and digital modules that were built have satisfied legitimate criteria from each aspect, according to the results of all the analyses previously mentioned. Additionally, the test of creative thinking capacity met the requirements for validity in terms of both content and language.

3.3 Practicality Results of Learning model based on Discovery Learning assisted by GeoGebra applets (PB-DLGA)

Based on research findings, a discovery-based learning methodology GeoGebra applet-assisted learning has met the practicality requirement. It is evident from expert assessments and the outcomes of learning process observations. From the experts' evaluation, it is clear that realistic and usable models and learning resources, such as modeling books, lesson plans, digital modules, and tests of creative thinking, are available. In the meantime, 4,38 people scored highly in the learning model's implementation results. It works well with Nieveen (1999). If experts and practitioners indicate that the learning model and its tools can be applied and that the implementation outcomes fell into the high or very high category, he claims that the learning model is practical.

If the implementation outcomes of the created learning model fall within the high category, that is normal. It is brought on by the development of a better learning approach based on discovery learning using GeoGebra applets (PB-DLGA), which aids in, facilitates, and promotes student comprehension of the quadrilateral materials. Students are encouraged to use the provided digital modules to think creatively as part of the learning process. Teachers created several activities for those modules that encourage pupils to think more imaginatively.

Based on these findings, the enhanced discovery learning model with GeoGebra (PB-DLGA) has met the requirements for expert evaluations and learning implementation outcomes. Using observation sheets from the PB-DLGA model's implementation, it is possible to determine the viability (practicality) of this model.

3.4 Results of The Efficacy (Effectiveness) of Discovery Learning Model Assisted by GeoGebra Applets (PB-DLGA)

The following are a discussion for each indicator in measuring or searching the efficacy (effectiveness) of DLGA learning model.

a. Classical Students Learning Completion

Based on the findings of the data analysis previously mentioned, test I's percentage of students that completed their creative thinking tasks in a traditional manner was 80.56 percent. In test II, 91.67

percent of the students' creative thinking abilities was completed in the traditional manner. If the findings of students' classical learning completion are considered, along with their capacity for creative thought, the completeness found in the I test result does not meet the standards of classical completion. In test II, meantime, it has satisfied the requirements for conventional completion.
According to Vygotsky, Trianto (2011: 39), the teacher provides assistance to pupils at the start of the learning process and gradually reduces it as they complete the tasks. The learning process will be more successful and have an impact on how thoroughly kids learn traditional lessons the more actively the students engage in the work.

b. Achievement of Learning Objectives

According to analytical results, the teacher-to-student relationship and the success of learning objectives in Test I have not been attained, however Test II revealed that the attainment of learning objectives has been achieved for each question item. As a result, while learning objectives from the post test of creative thinking ability in test II have been met, those from the post test of creative thinking ability in test I have not been met for every question item.

This perspective is in line with the findings of a study by Yuliani and Saragih (2015), according to which "the results of learning purpose achievement are utilized to seeing the predicted achievement of learning objectives." This outcome indicates that finding the anticipated attainment of learning completeness is to determine the learning objectives.

It can be said that the accomplishment of the learning objectives demonstrated that the developed learning model met the criteria for efficacy (effectiveness).

c. Students' and Teacher's Activities

In test I, the average percentage of time used by students fell within the range of 30.22, 55.33, and 2.17. The typical amount of time spent by students on tasks like listening to explanations from teachers or peers is 30.22% of the total time allotted for each meeting. At test II, it rises to 32.06 percent. Tests I and II took up a percentage of the total time allotted, which is acceptable. It demonstrates how the PB-DLGA model can limit the teacher's control over the actions of the students.

38.89% of each meeting's time is typically spent by teachers on activities that include explaining material or disseminating information. These activities' time percentages exceed the applicable ideal time tolerance interval's top limit. It demonstrates that some instructor explanations or material are not required by or taken into account by students. Overall, the learning process activities of the students and teachers have met the highest standards. Theoretically, the efficacy (effectiveness) requirements have been met by student and teacher activities during the learning process. This outcome is consistent with Sinaga's (2008) assertion that an effective learning model is only possible if both student and teacher activities occur at the appropriate moment.

d. Teacher's Ability to Manage Learning

This teacher' ability can be seen from three aspects observed that are teacher's ability to manage syntaxes, time, and class situation. In Test I, aspect of teacher's ability in managing syntax was quite good for 3.39. Then, in Test II it increases to 3.43. teacher's ability to manage syntax was quite

good. It identifies that teacher was able to teach using syntax of PB-DLGA model started from stimulus to conclusion.

The three observable aspects—the instructor's ability to control learning syntax, manage time, and manage the classroom environment—show how well the teacher can manage learning. In the first trial, the teacher's proficiency in controlling the acquisition of syntax was pretty strong, scoring 3.39. Then, it went up to 3.43 in the second experiment. The instructor does an excellent job of overseeing the category's learning of syntax. This shows that instructors may instruct students using the stimulus-to-conclusions PB-DLGA model syntax. This is due to the low number of students who inquire about using the geogebra applet to gather data. At the data collecting step, using the geogebra applet, the majority of the students were able to complete it independently.

e. Student and teacher reactions

The learning component was regarded as extremely beneficial in the learning process on average in 88.9 percent of teacher replies and helpful in the learning process in 33.3 percent of teacher responses. Additionally, 33.3 percent of the results of the assessment came into the good category, and 77.78 percent of the teacher's conclusions about the learning component fell into the very good category. The two comments make it evident that the instructor has a favorable opinion of the PB-DLGA model's components.

Daryanto (2010) argues that learning is a process of change, specifically a step taken by a person to bring about a broad change in behavior as a result of interaction with the environment. This is due to the complexity of learning and students' free will to learn or not.

Additionally, the teacher's stimulus—feedback and reinforcement—was tailored to the characteristics of the students after analyzing the context of the class, which contributed to the students' positive response. The instructor creates a lesson plan based on the characteristics of the students that includes student-led activities, allotted time, and assessments tailored to the created model. Teaching programs are also included in learning resources like digital modules in order to assist students in resolving problems and accomplishing learning objectives. As a result, it can be said that the learning model created improves students' learning processes.

3.5 Improving Students' Creative Thinking Ability Through Geogebra Applet-Assisted Discovery Learning-Based Learning Model (PB - DLGA).

Students' understanding of creative thinking will significantly grow when the PB-DLGA model is used, provided the learning model is of high quality, valid, applicable, and efficient. The pretest and posttest results of the trials' creative thinking assessments, known as N-Gains, will demonstrate the improvement.

The entire gain in creative thinking obtained falls into the "medium" category if the categorization stated in Chapter III is applied to the average value of N-Gain, which is 0.7. According to the created PB-DLGA model, creative thinking abilities have grown with a significant increase with an N-Gain value of 0.7, or a Gain percentage of 70%, falls into the "mid" group.

Table 2. Summary of N-Gain Results of Creative Thinking Ability

N-Gain	Interpretation	Total students
$g > 0,7$	Tall	8
$0,3 < g \leq 0,7$	Currently	17
$g \leq 0,3$	Low	0

According to the table above, 8 students either achieved a Gain score in the range of $g > 0.7$ or saw an improvement in their creative thinking abilities that fell into the "High" category. There were 17 students who saw an improvement in their critical mathematical thinking abilities in the "Medium" group or who had a gain score of 0.3 to g 0.7, but no one who did so in the "Low" category or who received a gain score of g 0.3.

Fluency, Flexibility, Elaboration, and Authenticity were the components of creative thinking talents examined in this study. Creative thinking abilities are evaluated according to each component as well as on an average or overall basis. The average pretest percentage on the fluency indicator is 63 percent, and the average posttest percentage is 79.67 percent, which reflects the worth of creative thinking abilities based on the ability element in each trial. The flexibility indicator's pre-test score is 60.67 percent, while the post-test average is 78.67 percent. The elaboration indicator's pre-test score is 49%, whereas the post-test average is 87.5 percent. Additionally, although the average posttest reaches 77 percent, the preetest on the authenticity indication is only 28.5%.

When using the PB-DLGA model to the provided open problems, students are required to exercise their creative thinking skills. This is because, if students' capacity for original thought is not fostered, mathematics will just become a topic that adheres to a set of procedures and imitates examples without grasping their meaning. The constructivism learning theory (Trianto, 2010) contends that for learning to take place, students must make their own discoveries, understand difficult material, compare new information to prior knowledge, and make changes to prior knowledge if it is no longer accurate. The application of pertinent learning will improve students' capacity for creative thought.. The ability to think creatively is a mental activity connected to sensitivity to issues, information, and fresh ideas, activities that are often not conducted with an open mind, according to Nehe, Surya, and Syahputra's (2017) research.

Thus, it can be concluded that the tried-and-true PB-DLGA paradigm helps pupils become more capable of thinking creatively.

4 Conclusion

The RPP, digital module, and TKBK are all recognized as appropriate learning resources by the Geogebra Applet-Assisted Discovery Learning-Based Learning Model (PB-DLGA). The Geogebra Applet-Assisted Discovery Instruction-Based Learning Model (PB-DLGA) and related tools (RPP, digital module, and TKBK) are very beneficial for implementing classroom learning. Learning has been achieved using the Geogebra Applet-Assisted Discovery Learning-Based Learning Model (PB-DLGA). These words have a source. The proportion of completed classical learning is above 85%, the proportion of learning goals met is above 75%, the proportion of time spent on teacher and

student activities is ideal, the proportion of learning that is managed effectively by the teacher is above 80%, and the proportion of positive feedback from both teachers and students is above 80%. When applied to rectangular flat form material, the PB-DLGA model can improve students' capacity for creative thought.

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