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Geometry Thinking Ability and Self Efficacy in Problem Based Learning Geogebra Assisted with Self Assessment

Ririn Widiastuti [1]✉ , Kartono Kartono [2], Scolastika Mariani [2]

[1] SMK Al Asror Gunungpati, Semarang, Indonesia
[2] Universitas Negeri Semarang, Indonesia

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Abstract

The application of learning models and the selection of learning assessments affect learning outcomes. Besides that, the use of interactive software can also make it easier for students to understand the concept of geometry. This study aims to explain the quality of mathematics learning and the ability of thinking geometry in terms of students' self-efficacy of learning of problem-based learning models assisted by GeoGebra with self-assessment. The study was conducted with a mixed-method approach. The study population was students of class XI Al-Asror Semarang Vocational School with sample class XI TPTU 1 as an experimental class and XI TPTU 2 as a control class. The results showed that the quality of learning of problem-based learning models assisted by GeoGebra with self-assessment of the ability to think geometry and self-efficacy in class XI Al-Asror Vocational High School Semarang was very good and the ability to think the geometry of students in the high self-efficacy group showed very good categories, self-efficacy was included in the good category, and low self-efficacy included in the good enough category. So of learning model of problem based learning assisted by GeoGebra with self-assessment can improve students' geometry skills and self-efficacy.

✉Correspondence:
No. 03, Jalan Legok Sari No.Raya, Patemon, Gunung Pati, Patemon, Kec. Gn. Pati, Kota Semarang, Jawa Tengah 50228
E-mail: ririnpmat@gmail.com

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INTRODUCTION

Each student has different abilities, especially related to the ability to think geometrically. Thinking that is meant here is a mental activity carried out by someone where he can connect something with something else to solve a problem (Musa, 2016). The process or way of thinking according to Suryabrata (2018) there are three steps, namely the formation of understanding, forming opinions, and drawing conclusions or forming decisions. Fluency in mathematical procedures (a method that is certain in solving a mathematical problem) is very important as a goal in learning mathematics (Gardiner, 2014; NCTM, 2014).

Mathematics is important to learn because the mathematical ability is very useful for students in the following learning at a further level or to overcome problems in daily life, and equip students with the ability to think logically, analytically, systematically, critically, and creatively (Wardono et al, 2016). The ability to think geometry is part of mathematics that can develop logical thinking skills. From the results of the assessment of the Trends International Mathematics and Science Study (TIMSS), it was found that the achievement of geometrical thinking achievement of fourth-grade students ranks 28th out of 50 participating countries. Compared to other developing countries, Indonesia is one of the countries that has the development of mathematics learning achievement, especially geometry is relatively low. (TIMSS: 2015).

Based on the explanation above, it was found that there are still many students who experience difficulties in learning geometry. According to Yazdani (2007), there is a strong positive correlation between the level of geometry thinking and geometric learning achievement. Many factors cause low student achievement in geometry, one of which is learning geometry is still taught conventionally and does not consider differences in the level of student thinking in geometry. This hinders the progress of students' thinking levels and abilities in geometry.

The researcher, who is one of the mathematics teachers at Al Asror Gunungpati Vocational School, Semarang, is faced with the problem that students' geometry thinking skills at this school are still low. Most students avoid various assignments that they find difficult. Students tend not to dare to ask both in the classroom and outside the classroom when there is the material they don't understand so when they get an assignment, they just copy the work of their friends, there is no desire to show the originality of their work. Their orientation is just how the tasks are collected without regard to the quality of their work. This results in students' ability to understand the material is still lacking and ultimately get grades that are still below the KKM. Most students find it difficult to answer the questions given. Students need to be guided and taught how to solve mathematical problems. This shows that the students' geometry thinking ability is still low.

One of the questions the researcher gave in the initial observations was the material on the circle equation. Of the 20 students, only 7 students were able to do the equation correctly.

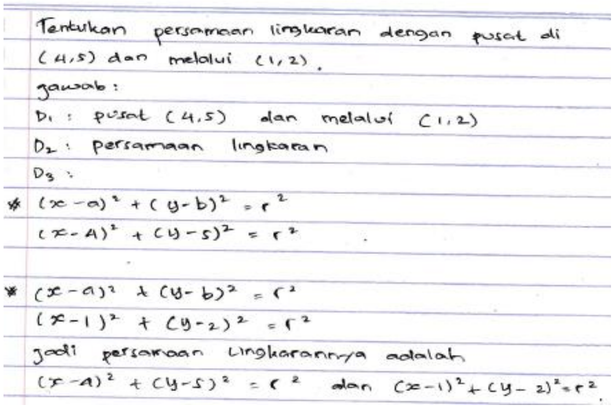
Tentukan persamaan lingkaran dengan pusat di (4,5) dan melalui (1,2).
jawab:
D1 : pusat (4,5) dan melalui (1,2)
D2 : persamaan lingkaran
D3 :
* (x-a)² + (y-b)² = r²
(x-4)² + (y-5)² = r²
* (x-a)² + (y-b)² = r²
(x-1)² + (y-2)² = r²
jadi persamaan lingkarannya adalah
(x-4)² + (y-5)² = r² dan (x-1)² + (y-2)² = r².

Figure 1. Results of student work on preliminary tests

Translate of Figure 1:
Determine the circle equation with the center at point (4,5) and through point (1,2).
Answer:
D_1: the center of circle is (4,5) and it throughs point (1,2)
D_2: the equation of circle
D_3:
$* (x-a)^2 + (y-b)^2 = r^2$
$(x-4)^2 + (y-5)^2 = r^2$

$* (x-a)^2 + (y-b)^2 = r^2$
$(x-1)^2 + (y-2)^2 = r^2$
Therefore, the equation of circle is
$(x-4)^2 + (y-5)^2 = r^2$ and
$(x-1)^2 + (y-2)^2 = r^2$

It can be seen in Figure 1 that students think there are two equations of a circle, even though the purpose of the problem is to have to find the radius first before being able to find out the intended circle equation. This means there are still many students who do not understand the questions and cannot think geometry well. Only 2 students can answer precisely that circle equation ie $(x-4)^2+(y-5)^2=18$. This means students cannot think of geometry that is good at solving problems. According to Noriza (2015), geometry has a greater chance of being understood by students than other branches of mathematics because geometric objects containing geometrical ideas can be found in the surrounding environment.

Ariyani et al (2013) suggested that one aspect that needs to be considered in learning geometry is the learning phase of student geometry. To be able to determine the level of thinking of students' geometry, the teacher must be able to describe students' thought processes in solving problems so they can know the level of students' thinking. Therefore, the teacher needs to develop a Van Hiele theory-based learning model that can respond to the needs of all students who vary in their level of thinking and geometrical abilities.

According to Van Hiele's theory in Abdussakir (2009), a person will go through five levels of thinking in learning geometry, namely level 1 (visualization), level 2 (analysis), level 3 (informal deduction), level 4 (deduction), and level 5 (rigor). Each level describes students' thought processes in the context of geometry. This level explains how students think and what geometrical ideas students think. The application of Van Hiele's theory is believed to be able to overcome students' difficulties in solving problems in geometry.

Halim and Mohini (2008) state that techniques for studying geometrical concepts should be implemented effectively using traditional approaches that concentrate more on memorizing geometrical concepts, students' learning experiences in geometry must be changed in more meaningful ways. In this study, one way to analyze students' geometrical thinking skills is by self-efficacy assessment. Self-efficacy is related to someone's assessment of their ability to complete a particular task or project. Improved self-assessment will be more easily developed if there is an interaction between students with one another. According to Yunianti (2016), self-efficacy is a belief that students must have to succeed in the learning process.

Wilkerson, et al (2018) suggested that modeling is an important practice in science, technology, engineering, and mathematics. Several learning models have been proven to have the potential to improve the ability to think geometry, one of which is a problem-based learning model (PBL) assisted by GeoGebra. The learning process uses a systemic approach to solving problems or challenges needed in everyday life (Trianto, 2007). Dewantara (2016) argues that PBL can change the learning process into a student center so that students are active, critical, and able to link learning with real-life to make learning more meaningful. According to Syahbana (2016) states that GeoGebra is a dynamic program that has facilities to visualize or demonstrate mathematical concepts as well as tools to construct mathematical concepts. The presence of computer equipment in the process of learning mathematics has been well received in educational devices. Examples of the use of computers in learning mathematics are the use of GeoGebra. Simple appearance and interactive use can make GeoGebra the right choice in conveying concepts, geometry, and calculus. The results of Simanjuntak, et al (2014) showed that GeoGebra learning media had a positive effect on students' understanding of concepts compared to normal learning.

In addition to the learning model, the self-assessment of students also affects the quality of learning outcomes. Wahyuni, et al (2013) suggested that assessment is an interpretation of measurement results and determination of learning outcomes. Assessment is used to assess the achievement of student competencies as material for preparing progress reports on learning outcomes (Muslich, 2014). Self-assessment (self-assessment) can foster self-confidence and responsibility in students because assessors who know exactly about themselves are students themselves and students become the best assessors of the results of their work. Kartono (2011) states that self-assessment can encourage students to be independent and increase their motivation. Self-assessment can be used to help develop students' ability to examine and think critically about the learning process that students live. According to Komalasari (2010), self-assessment is carried out based on clear and objective criteria. Therefore, the steps of self-assessment by students are (1) determining competency or ability aspects to be assessed, (2) determining the assessment criteria to be used, (3) formulating an assessment format, data in the form of scoring guidelines, checklist, or rating scale, (4) asking students to do a self-assessment, (5) the teacher examines a random sample of assessment results to encourage students to always carry out a careful and objective self-assessment, (6) submit feedback to students based on the results of the study of the sample Random results are taken.

From some of the above descriptions, researchers have a desire to further examine the problems that occur in learning mathematics in vocational schools, especially in Al Asror Gunungpati Vocational School, Semarang class XI on geometry transformation material. In this study will be analyzed in more depth the ability to think geometry and self-efficacy in problem-based learning assisted by GeoGebra with self-assessment.

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METHODS

This research is a mixed methods research. The mixed-methods design used in this study is a combination of the concurrent embedded design model. Concurrent Embedded was chosen in this study because the data obtained consisted of qualitative data, namely geometric thinking interviews, self-efficacy questionnaires, and self-assessment questionnaires, while quantitative data were geometric thinking abilities.

The study was conducted at Al Asror Gunungpati Vocational School, Semarang in the 2018/2019 school year with the population for this study were all students of class XI. Determination of the sample class using the cluster random sampling technique and selected two sample classes namely class XI TPTU 1 as the experimental class and class XI TPTU 2 as the control class.

Data sources in this study are students and teachers. Data obtained from tests of geometric thinking skills, self-efficacy and self-assessment questionnaire results, observations of the mathematics learning process with the Problem Based Learning learning model with self-assessment assisted by GeoGebra in class XI, and the results of interviews with class XI students. Based on these data, the process of learning mathematics in class XI is described and followed by a description of students' geometric thinking abilities and self-efficacy.

Data collection techniques used in this study consisted of observation techniques, tests, questionnaires, documentation, and interviews (interviews). The questionnaire technique consists of two types, namely the provision of self-efficacy questionnaires to see the level of self-efficacy that each student has and the student self-assessment questionnaire to determine student responses regarding learning that has been carried out.

Analysis of the data in this study includes initial data analysis and final data analysis. Final data analysis consists of prerequisite tests, average geometric thinking ability tests based on KKM, classical completeness test, average similarity test, enhancement test, and influence test. Initial data analysis includes the Normality test, the homogeneity test, and the two average similarity tests. Prerequisite tests using final data include tests of normality and homogeneity tests.

RESULTS AND DISCUSSION

Preliminary data from the experimental class and control class were obtained from the initial geometry thinking ability test (initial TKBG). The initial data of the two classes can be seen in Table 1.

Table 1. Summary of Preliminary Data of Experiment and Control Classes

Aspect	Experimentation Class	Control class
Student's number	20	17
Average	45.70	45.47
Maximum	60	59
Minimum	33	34
Variance	68.27	56.60
Standard deviation	8.263	7.52

From the initial data normality test using the H_0 the hypothesis that is normally distributed data obtained a sig value of $0.200 > 0.05$ so that H_0 is accepted. This shows that the initial data of the experimental class and the control class are normally distributed. Furthermore, from the homogeneity test the initial data using the H_0 is the data derived from a homogeneous population obtained a sig value of $0.332 > 0.05$ so that H_0 is accepted, meaning that the data comes from a homogeneous population. Then from the similarity test the average value of the initial data with H_0 ie there is no difference in the average thinking ability of the experimental class and the control class obtained sig value of $0.2 > 0.05$, then H_0 is accepted.

The learning instruments that will be used were validated by 3 experts namely 2 lecturers and 1 senior mathematics teacher. The intended learning tools include syllabus, lesson plans, worksheets, TKGB, learning achievement sheets, student responses, interview guides, and self-efficacy questionnaire. The average score of validity is above 80 with a very good category. Furthermore, an empirical trial was conducted using statistics which include validity, reliability, distinguishing power, and difficulty level of questions on the initial TKBG set, the initial TKBG, the final TKBG, and the self-efficacy questionnaire.

From the initial TKBG empirical test, it was found that all questions from numbers 1 to 5 were declared valid. In the problem differentiation section, several questions are having different good power, namely items 1, 3, 4, and 5, while item number 2 has enough different power. In the difficulty level section, items number 1, 2, 4, and 5 questions are included in the medium category, while number 3 is included in the easy category. From the final TKBG empirical test it was found that all questions from numbers 1 to 5 were declared valid. In the differentiating power section of the questions, all questions have good different power and all questions have a moderate difficulty level. From the self-efficacy questionnaire empirical test. it was found that only item number 24 was invalid from the 25 question items given.

Based on these observations it can be stated that the implementation of learning, in general, is categorized as good. The average score of performance in the first meeting was less than optimal, which is 2.7. That is because teachers and students have not adapted to GeoGebra-aided problem-based learning, but also because of ineffective time management. After learning the first meeting, researchers discuss with observers to overcome these deficiencies. The results of the discussion include making the time of students more effective in identifying problems and to explain the results of problem identification and to limit the time of students to work on more complex problems. After implementing input from the observer, the average score of learning accomplishment increased, namely at the second meeting by 3.0, the third meeting by 3.4, and the fourth meeting by 3.7. This means that learning based on GeoGebra-assisted learning runs well and effectively.

Data analysis of student responses was obtained from the student response sheet instrument in measuring student responses during the GeoGebra-based problem-based learning model learning with self-assessment. The results of the questionnaire analysis of student responses are presented in Table 2.

Table 2. Student Questionnaire Results

Indicator	Positive (%)	Negative (%)
Student responses to the learning model applied	86.67	13.33
Student responses to learning instruments	78.33	21.67
Student responses to learning material	77.50	22.50
Student responses to learning media	67.50	32.50

Student responses to the overall learning process are categorized as high because the average positive response of students to learning is 77.50%; This means that learning has a positive impact on students.

Before testing the effectiveness of learning on the ability to think geometry, first the prerequisite test is done, namely the final data normality test and the final data homogeneity test. From the final data normality test the sig value of $0.46 > 0.05$ resulted in H_0 being received. This shows that the final data for both the experimental and control classes are normally distributed. From the homogeneity test, the final data obtained a sig value of $0.076 > 0.05$ which results in H_0 being received. This shows that the variance of the final TKBG of the experimental class is the same as the variance of the final TKBG of the control class.

The mastery learning test based on the KKM value of 65 obtained a sig value of $0.000 < 0.05$. This causes H_0 to be rejected, meaning that the average value of the geometric thinking ability of the experimental class students reaches the minimum completeness criteria limit of 65. From the results of the final test (posttest) of the experimental class, it is obtained that students who reach KKM (x) are 19 students from the number of students in the experimental class (n) is 20 students. The results of the final test calculation of the experimental class obtained the value of $z_{count} = 2.1$, with $z_{value(0.5-\alpha)} = z_{0.45} = 1.64$. Based on these results, the value of $z_{count} = 2.1 > 1.64 = z_{0.45}$ results in H_0 being rejected; meaning that the proportion of students completeness in the ability to think the geometry of students in GeoGebra-aided problem-based learning with self-assessment that has reached KKM more than or equal to 75%.

Based on the results of two similarities test average between the experimental class and the control class obtained a sig value of $0.011 < 0.05$ so that H_0 is rejected. This means that the average geometric thinking ability of students in GeoGebra-aided problem-based learning with self-assessment is more than the average geometry thinking ability of students in classes using conventional learning. Furthermore, based on the results of the Independent sample t-test on the value increase data, a sig value of $0.000 < 0.05$ is obtained so that H_0 is rejected. This means that the improvement of students 'geometry thinking skills in class with GeoGebra-based problem-based learning models with self-assessment is higher than the students' geometry thinking ability in classes using conventional learning.

The influence test in this study aims to examine the effect of self-efficacy on students' geometrical thinking skills. Self-efficacy data as independent variables are obtained from self-efficacy questionnaire sheets while data on students' geomantic thinking ability as dependent variables is obtained through the Geometry Thinking Ability Test. From this influence test, obtained a sig value of $0.000 < 0.05$ resulting in H_0 rejected. This means that there is an influence between self-efficacy and students' geometrical thinking skills. R square value of 0.610 was also obtained, meaning that the magnitude of the effect between self-efficacy and students' geometrical thinking skills was $0.610 = 61\%$ and the remaining 39% was influenced by other factors. The simple linear regression equation is

$$Y = 40.575 + 0.532X$$

Based on self-efficacy, students are grouped into 3 groups: 4 students are in the low self-efficacy group, 22 students are in the moderate self-efficacy group, and 10 students are in the high self-efficacy group. Based on the results of the self-efficacy questionnaire analysis, 6 students from the experimental class were selected as research subjects consisting of 2 low group students, 2 medium group students, and 2 students from the high group.

Geometry Thinking Ability of Students in High Groups

Description of the ability to think geometry in research subjects with high self-efficacy as follows.

(1) Visualization

The 1st high research subject (SP1T) can mention information presented in the problem systematically and can understand and draw a picture of a known problem. This shows that SP1T is very capable of understanding the question well. The results of interviews with SP1T showed that there were no significant obstacles for SP1T in fulfilling visualization aspects.

The 2nd high research subject (SP2T) can also mention the information presented in the problem systematically and can understand and draw a picture of a known problem. Besides that, each problem students write down the information needed and write the conclusion solutions to the problem. This shows that SP2T is very capable of understanding the question well. The results of interviews with SP2T also showed that there were no significant obstacles for SP2T in fulfilling visualization aspects.

Based on the validity of qualitative data, the results of interviews with peers, namely subject E01, show that students can mention the information presented in the problem systematically and can understand and draw pictures of known problems. The results of teacher interviews and observations of student activities also show that students with high self-efficacy can systematically mention information from questions.

(2) Analysis

SP1T can determine the angle and area of the known problem, seen from students can determine the shadow and solve the problem. This shows that SP1T can determine shadows and solve them with the concept of geometry. The results of interviews with SP1T also showed that subjects could understand the objectives and solve the questions given.

SP2T can also determine the angle and area of the known problem, seen from students can determine the shadow and solve the problem. This shows that SP2T is also able to determine shadows and solve them with the concept of geometry. The results of interviews with SP2T also showed that there were no significant obstacles for SP2T in determining shadows and solving them with the concept of geometry.

Based on the validity of qualitative data, the results of interviews with peers, namely subject E01, show that students can determine the angle and area of the known problems, it can be seen from students being able to determine shadows and solve the problem. The results of teacher interviews and observations of student activities also show that students with high self-efficacy can determine angles, areas and can determine their shadows correctly.

(3) Informal Deduction

SP1T can mention information that is known following the problem and can draw shadows from known problems. This shows that SP1T can draw shadows so that students are easier to solve problems. The results of interviews with SP1T also showed that subjects can draw shadows well.

SP2T can also draw well that can simplify problems and write mathematical formulas that are appropriate to the problem. This shows that SP2T is also able to understand the problem well so that it understands which formula is used in solving the problem. The results of interviews with SP2T also showed that there were no significant obstacles for SP2T in drawing or writing formulas to solve the given problems.

Based on the validity of qualitative data, the results of interviews with peer students, namely subject E01, show that students can draw shadows according to the problem. The results of teacher interviews and observations of student activities also show that students with high self-efficacy can draw shadows according to problems.

(4) Deduction

SP1T can provide explanations and logical reasons such as using the right processes and procedures to solve problem number 1. This shows that SP1T can provide a logical explanation in solving the given problem although still hesitant in writing conclusions end. The results of interviews with SP1T also showed that subjects could solve the problems given through a coherent process.

SP2T can also solve problems like number 1 with reasons and explanations for choosing the right procedure. This shows that SP2T was also able to solve the problems given through a coherent and appropriate process. The results of interviews with SP2T also showed that there were no significant obstacles for SP2T in compiling a resolution process to resolve the given problems.

Based on the validity of qualitative data, the results of interviews with peers, ie subject E01, show that students can explain and decide on the right procedure or process to solve problem number 1. The results of teacher interviews and observation of student activities also show that students with high self-efficacy can explain the reasons to solve problems precisely and clearly.

(5) Rigor

SP1T can make plans to solve the problem, but sometimes the final solution is not appropriate. This shows that SP1T is sometimes still less thorough in completing the problem-solving process. The results of interviews with SP1T also showed that subjects could solve the problems given through a coherent process, but sometimes in drawing conclusions it still had constraints.

SP2T can also design a complete plan that will be used, but sometimes the plans that have been made are not implemented properly. This shows that SP2T is still often in a hurry in solving problems so that the settlement process does not finish until the end. The results of interviews with SP2T also showed that sometimes there were obstacles for SP2T in completing the resolution process to resolve the given problem.

Based on the validity of qualitative data, the results of interviews with peers, namely subject E01, show that students can plan a solution that will be used, but sometimes it is hampered to write the conclusions. The results of teacher interviews and observations of student activities also show that students with high self-efficacy can write conclusions but sometimes are not fully implemented.

Geometry Thinking Ability of Students in Medium Groups

The description of the ability to think geometry in research subjects with moderate self-efficacy is as follows.

(1) Visualization

The 1st medium research subject (SP1S) can mention the information presented in the problem systematically and can understand and draw a picture of a known problem. This shows that SP1S can understand the problem well. The results of interviews with SP1S showed that there were no significant obstacles for SP1S in fulfilling visualization aspects.

The 2nd medium research subject (SP2S) can also mention the information contained in the problem systematically and can understand and make a picture of a known problem. This shows that SP2S can understand the problem well. The results of interviews with SP2S also showed that there were no significant obstacles for SP2S in fulfilling visualization aspects.

Based on the validity of qualitative data, the results of interviews with peers, namely subject E19, show that students can name information systematically and can understand and draw pictures of known problems. The results of teacher interviews and observations of student activities also show that students with moderate self-efficacy can mention information systematically and can understand and draw pictures of known problems.

(2) Analysis

SP1S can determine the angle and area of the known problem, seen from students can determine the shadow and solve the problem. This shows that SP1S can determine the shadow of the problem so that it can be solved by the concept of geometry. The results of interviews with SP1S also showed that subjects could understand the objectives and solve the questions given.

SP2S can also determine the angle and area of the known problem, seen from students can determine the shadow and solve the problem. This shows that SP2S is also able to understand the questions well enough so that there is no difficulty in solving problems in the given questions. The results of interviews with SP2S showed that there were no significant obstacles for SP2S in determining shadows and solving the problem.

Based on the validity of qualitative data, the results of interviews with peers, namely subject E19, show that students can determine the angle and area of the questions that are known, visible from students can determine the shadow and solve the problem. The results of teacher interviews and observations of student activities also show that students with high self-efficacy can determine the angle and extent of the known problems, seen from students can determine shadows and solve these problems properly.

(3) Informal Deduction

SP1S can mention information that is known following the problem and can draw a shadow of a problem that is known. This shows that SP1S is quite capable of simplifying questions into a simpler form that is through images so that students are easier to solve problems. The results of the interview with SP1S also showed that the subject could simplify the questions into a simpler form that is through the picture properly.

SP2S can also mention information that is known following the problem and can draw shadows from known problems. This shows that SP2S is also able to understand the problem well so that it can draw shadows in solving the problem. The results of interviews with SP2S also showed that there were no significant obstacles for SP2S in drawing to solve the given problems.

Based on the validity of qualitative data, the results of interviews with peers, namely subject E19, show that students can name information that is known following the problem and can draw shadows from known problems. The results of teacher interviews and observations of student activities also show that students with moderate self-efficacy can make shadow images of well-known questions.

(4) Deduction

SP1S can provide an explanation and reason about the procedure used in solving problems although still hesitant in writing the conclusions. This shows that SP1S can provide a logical explanation so that solving the problems given can be resolved. The results of interviews with SP1S also showed that subjects could solve the problems given through a coherent process.

SP2S can also solve problems using systematic procedures by providing explanations and reasons that are quite logical. This shows that SP2S is also quite able to solve the problems given through a coherent and precise process, although still hesitant in writing the conclusions. The results of interviews with SP2S also showed that there were no significant obstacles for SP2S in compiling the process of resolving issues to be resolved.

Based on the validity of qualitative data, the results of interviews with peers, namely subject E19, show that students can work on problems and use explanations about the procedures and processes used but sometimes are still hesitant in writing conclusions. The results of teacher interviews and observations of student activities also show that students with self-efficacy can explain the procedures used to solve problems but sometimes are still hesitant in writing conclusions.

(5) Rigor

SP1S can make plans to solve the problem, but sometimes the final solution is not appropriate. This shows that SP1S sometimes in concluding still has obstacles. The results of interviews with SP1S also showed that subjects could solve the problems given through a coherent process, but sometimes in drawing conclusions they still have obstacles.

SP2S can also design a settlement plan that will be used, but sometimes the plans that have been made are not implemented properly. This shows that SP2S is also still often in a hurry in solving problems so that the settlement process is not finished until the end. The results of interviews with SP2S also showed that sometimes there were obstacles for SP2S in completing the resolution process to resolve the given problem.

Based on the validity of qualitative data, the results of interviews with peers, namely subject E19, show that students can plan solutions to be used, but are sometimes hampered to carry out their plans. The results of teacher interviews and observations of student activities also show that students with self-efficacy can plan problem-solving, but sometimes in drawing conclusions they still have obstacles.

Geometry Thinking Ability of Students in Low Groups

Description of the ability to think geometry in research subjects with low self-efficacy as follows.

(1) Visualization

The 1st low research (SP1R) can mention the information presented in the problem systematically but cannot comprehend and draw a picture of the known problem. This shows that SP1R did not understand the matter well. The results of interviews with SP1R also showed that subjects were still constrained in making drawings.

SP2R can also mention information presented in the problem systematically but cannot comprehend and draw a picture of a known problem. This shows that SP2R has not been able to understand the questions. The results of interviews with SP2R also showed that there were still obstacles for SP2R in fulfilling visualization aspects.

Based on the validity of qualitative data, the results of interviews with peers, namely subject E14, showed that students rewrote the questions obtained as the information they got from the questions. The results of teacher interviews and observations of student activities also showed that students with low self-efficacy were not good at understanding and drawing pictures of known problems.

(2) Analysis

SP1R can determine the angle and area of the known problem. But not yet able to determine the shadow and solve the problem. The results of the interview with SP1R also showed that the subject did not understand the objectives and solve the given questions.

SP2R can also determine the angle and area of the known problem. But not yet able to determine the shadow and solve the problem. This shows that SP2R did not understand the problem well so that it was difficult to solve the problem in the given problem. The results of interviews with SP2R also showed that there were obstacles for SP2R in determining the shadow and solving the problem.

Based on the validity of qualitative data, the results of interviews with peer students, namely subject E14, show that students have not been able to determine shadows and solve the problem. The results of teacher interviews and observations of student activities also show that students with low self-efficacy have not been able to determine shadows and solve the problem properly.

(3) Informal Deduction

SP1R can only mention information that is known following the problem but has not been able to draw a shadow of a known problem. This shows that SP1R is quite able to determine the shadow, but students are still constrained in determining the formula that will be used in solving problems. The results of interviews with SP1R also showed that subjects were not able to draw shadows from known problems.

SP2R can also only mention information that is known to be following the problem but has not been able to draw shadows from known problems. This shows that SP2R also has not been able to understand the problem and it is still difficult to determine which formula is used in solving the problem. The results of the interview with SP2R also showed that there were significant obstacles for SP2R in writing the formula to solve the given problem.

Based on the validity of qualitative data, the results of interviews with peers, namely subject E14, show that students can only mention information that is known following the problem but have not been able to draw shadows from known problems. The results of teacher interviews and observations of student activities also show that students with low self-efficacy can only mention information that is known to suit the problem but have not been able to draw shadows from known problems.

(4) Deduction

SP1R unable to write conclusions from problem-solving in solving problems. This shows that SP1R has not been able to write the conclusions. The results of interviews with SP1R also showed that the subject was not able to resolve the problem given through a coherent process.

SP2R also cannot provide a logical explanation of the procedures used when resolving problems. This shows that SP2R has not been able to solve the problems given through a coherent and appropriate process. The results of interviews with SP2R also showed that there were significant obstacles for SP2R in developing the resolution process to resolve the given problems.

Based on the validity of qualitative data, the results of interviews with peers, ie subject E14, showed that students could not explain plausible reasons for choosing the procedure used. The results of teacher interviews and observations of student activities also show that students with low self-efficacy cannot provide logical reasons and explanations about the procedures and processes in writing the conclusions.

(5) Rigor

SP1R unable to make detailed settlement plans to find solutions to problems. This shows that SP1R still does not understand in completing the problem-solving process. The results of interviews with SP1R also showed that subjects could not solve the problems given through a coherent process.

SP2R also cannot design the procedure that will be made in solving the problem. This shows that SP2R also still does not understand in solving problems. The results of interviews with SP2R also showed that there were obstacles for SP2R in completing the resolution process to resolve the given problem.

Based on the validity of qualitative data, the results of interviews with peers, namely subject E14, show that students cannot plan to solve the given problem. The results of teacher interviews and observations of student activities also show that students with low self-efficacy cannot plan procedures to be carried out when solving problems.

In general, each subject has varied geometrical thinking abilities. The ability to think the geometry of students in high self-efficacy groups shows a very good category because students are very able to master in identifying problems and then present problems into images or formulas appropriately and systematically. This is useful in planning strategies and linking problems to obtain the solutions to be achieved.

The ability to think the geometry of students in the self-efficacy group is included in either category. This is because students can master in identifying problems and then present problems in pictures or formulas appropriately and systematically, but sometimes obstacles are not careful enough to end the problem-solving process. The ability to think about the geometry of students in the low self-efficacy group is quite good. This is because students are quite capable of identifying problems but are still constrained in turning problems into mathematical concepts.

A summary of the results of qualitative research on the ability to think geometry based on self-efficacy can be seen in Table 3.

Based on the results of the analysis in this study, it was generally obtained that students belonging to the high self-efficacy group had excellent geometrical thinking skills. Four of the five components of thinking geometry, students can master it, while the other components can master students and only have obstacles that are not so meaningful, namely the rigor component. The obstacle that is still often experienced is when students write the conclusions of problem-solving coherently and clearly.

The results of this study are following research conducted by Shofiah and Rhodhotussalamah (2014: 228), where the results indicate that people who have high self-efficacy will have confidence about the ability to organize and complete a task needed to achieve certain results in various forms and degree of difficulty. Besides, students having good self-efficacy and tend to positively will have an impact on students' enthusiasm in learning the material.

The group of students who have moderate self-efficacy in the ability to think geometry in general shows good results. Of the five components measured, one component that is highly controlled by students in this group is the visualization component, namely, students are very able to mention information presented in the problem systematically and can understand and draw pictures of known problems. This component becomes a key component when students plan the problem-solving process. This is because when students can draw pictures, students understand problems and can simplify problems through drawings, then write a formula that will be used to solve the problem. While the obstacles that are still a problem for students with moderate self-efficacy are the components of deduction and rigor that are still hesitant in writing the conclusions of problem-solving. This causes the final results of solving the problem is not as expected.

Students in the low self-efficacy group show the results of geometric thinking skills that are still low. This is because of the five components analyzed, only the analysis component that some students can carry out well. In other components, students still need to be given more intense training, reinforcement, and guidance by the teacher, such as the informal visualization and deduction component

Table 3. Summary of Geometry Thinking Ability Analysis Results Based on Self Efficacy

Component	Group		
	High	Medium	Low
Visualization	Students are able to write information from problems systematically and are able to draw pictures of known problems	Students are able to write information from problems systematically and are able to draw pictures of known problems	Students are able to systematically information from questions and are able to draw pictures of known problems
Analysis	Students are able to determine shadows and solve the problem	Students are able to determine shadows and solve the problem	Students have not been able to determine the shadow and solve the problem
Informal Deduction	Students are able to mention information that is known in accordance with the problem and are able to draw shadows from known problems	Students are able to mention information that is known in accordance with the problem and are able to draw shadows from known problems	Students are able to mention information that is known in accordance with the problem but have not been able to draw shadows from known problems
Deduction	Students can show the shadow shapes of known problems. But still hesitant to write the final conclusions of solving the problem	Students can show the shadow shapes of known problems. But still hesitant to write the final conclusions of solving the problem	Students can show the shadow shapes of known problems. But not yet able to write the final conclusions of solving the problem
Rigor	Students have not been able to write the final conclusions of solving problems and have not been able to check back on the results of their work	Students have not been able to write the final conclusions of solving problems and have not been able to check back on the results of their work	Students have not been able to write the final conclusions of solving problems and have not been able to check back on the results of their work

that can be trained by giving direction on how to draw and determine shadows using geometric concepts. Besides that, deduction and rigor components are also an obstacle for low self-efficacy students because students are still unable to write the conclusions of problem-solving.

CONCLUSION

Based on the results of the study it can be concluded that the learning model of problem-based learning with GeoGebra assisted with self-assessment supports the ability to think geometry and self-efficacy of grade 11 SMK Al Asror Gunungpati and there is an influence between self-efficacy and students' geometry thinking abilities by 61% and the remaining 39% is influenced by another factor.

The ability to think geometry and self-efficacy in problem-based learning based on GeoGebra with self-assessment can be described as follows. The ability to think about the geometry of students in high self-efficacy groups shows a very good category. The ability to think the geometry of students in the self-efficacy group is included in either category. The ability to think about the geometry of students in the low self-efficacy group is quite good. So of learning model of problem based learning assisted by GeoGebra with self-assessment can improve students' geometry skills and self-efficacy.

REFERENCES

Abdussakir. 2009. Pembelajaran Geometri Sesuai Teori Van Hiele. *Jurnal Kependidikan dan Keagamaan*, 2 (1): 1-13.

Ariyani, D. F., Wuryanto, W., & Prabowo, A. 2013. Keefektifan Pembelajaran MMP Terhadap Kemampuan Pemecahan Masalah Disertai Identifikasi Tahap Berpikir Geometri. *Unnes Journal of Mathematics Education*, *2*(2) : 71 – 77.

Dewantara, D. 2016. Penerapan Model Pembelajaran Problem Based Learning untuk Meningkatkan Aktivitas dan Hasil Belajar Siswa pada Pelajaran IPA (Studi pada Siswa Kelas V SDN Pengambangan 6 Banjarmasin). *Jurnal Paradigma,* 11 (2): 41-44.

Gardiner, A.D. 2014. Teaching mathematics at secondary level. *The De Morgan Gazette,* 6 (1): 1-215.

Kartono. 2011. Efektivitas Penilaian Diri dan Teman Sejawat untuk Penilaian Formatif dan Sumatif pada Pembelajaran Mata Kuliah Analisis Kompleks. UNNES.

Kementrian Pendidikan dan kebudayaan. 2014. Model Pembelajaran Berbasis Masalah. Badan Pengembangan Sumber Daya Manusia Pendidikan dan Kebudayaan dan Penjaminan Mutu Pendidikan.

Komalasari, K. 2010. *Pembelajaran Kontekstual: Konsep dan Aplikasi*. Penerbit: PT Refika Aditama. Bandung.

Musa, L.A.D. 2016. Level Berpikir Geometri Menurut Teori Van Hiele Berdasarkan Kemampuan Geometri dan Perbedaan Gender Siswa Kelas VII SMPN 8 Pare-Pare. *Al-Khwarizmi: Jurnal Pendidikan Matematika dan Ilmu Pengetahuan ALam*, *4*(2): 103-116.

Muslich, M. 2014. Pengembangan Model Assessment Afektif Berbasis Self Assessment dan Peer Assessment di SMA Negeri 1 Kebomas. *Jurnal Kebijakan dan Pengembangan Pendidikan*, 2 (2): 143-148.

Noriza, M. D., Kartono, K., & Sugianto, S. (2015). Kemampuan Pemecahan Masalah dan Disposisi Matematis Siswa Kelas X pada Pembelajaran Berbasis Masalah. *Unnes Journal of Mathematics Education Research*, *4*(2): 66-75.

Shofiah, V. dan Raudatussalamah. 2014. *Self-Efficacy dan self Regulation sebagai unsur penting dalam pendidikan karakter.* Jurnal Penelitian Sosial Keagamaan, 17 (2) : 214-229

Simanjuntak, Y.L., Hartoyo, A., & Yani, A. 2014. Pengaruh Penggunaan Software Geogebra Terhadap Pemahaman Konsep Siswa pada Materi Lingkaran di Kelas XI SMA. *Jurnal Pendidikan dan Pembelajaran,* 3 (5): 1-10.

Suryabrata, S. 2018. Psikologi Pendidikan. Yogyakarta: PT. Raja Grafindo Persada.

Syahbana, A. 2016. *Belajar Menguasai GeoGebra (Program Aplikasi Pembelajaran Matematika)*. Palembang: NoerFikri Offset.

Trianto. 2010. *Model Pembelajaran Terpadu*. Jakarta: PT Bumi Aksara.

Wahyuni, S.E., Deniyanti, P., & Meiliasari. 2013. Mengembangkan Kemampuan Berpikir Geometris Pada Pokok Bahasan Segiempat Dengan Teori Van Hiele dan Pendekatan PMRI, Prosiding Seminar Nasional Matematika dan Pendidikan Matematika FMIPA UNY 2013: MP-533 – MP-540.

Wardono, Waluya, S.B., Mariani, S. & S Candra D (2016). Mathematics Literacy on Problem Based Learning with Indonesian Realistic Mathematics Education Approach Assisted Elearning Edmodo. Journal of Physics: Conference Series 693: 012014 doi:10.1088/1742-6596/693/1/012014.

Wilkerson, M. H., Bautista, A., Tobin, R. G., Brizuela, B. M., & Cao, Y. 2018. More than meets the eye: patterns and shifts in middle school mathematics teachers' descriptions of models. *J Math Teacher Educ*, 21(1), 35-61.

www.timss2015.org

Yazdani, M. 2007. Correlation between Students' level of Understanding Geometry According to the Van Hieles' Model and Students' Achievement in Plane Geometry. *Journal of Mathematical Sciences & Mathematics Education*, 1(5), 40-45.

Yunianti, E., Jaeng, M., & Mustamin. 2016. Pengaruh Model Pembelajaran dan Self-Efficacy Terhadap Hasil Belajar Matematika Siswa SMA Negeri 1 Parigi. *e-Jurnal Mitra Sains,* 4(1)*:* 8-19.