SDL EFFECTIVENESS WITH STUDENT CENTERED APPROACH TO SELF EFFICACY AND MATHEMATICAL REASONING

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Abstract

The research aims to find the effectiveness of the self-direct learning model with the student centered approach rather than the conventional learning model of self efficacy and the ability of mathematical reasoning on derivative material. The population in this study is the students of class XI SMAN 5 in 2022/2023 academic year. The sampling retrieval technique in this study uses a random sampling cluster technique. A sample of 105 students are taken that consists of three classes. The data-collection techniques used are interviews, documentaries, questionnaires and tests. The research instrument is a Self Efficacy questionnaire and a test of learners ability of mathematical reasoning which have already tested its validity and reliability at a 5% significant level. The techniques used for data analysis are tests of proportion, one sampe t test, independent t test, manova test and τ^2 hotelling test that have previously been carried out the prerequisite test of normality and homogeneity. The results of the study reveals that the model of self direct learning with the student centered approach towards self efficacy and the ability of mathematical reasoning is more effective than the conventional learning model.

Keywords: Effectiveness, SDL, Student Centered Approach, Self Efficacy, Mathematical reasoning

1. INTRODUCTION

Education has several levels, including basic education, secondary education, and higher education. In every education, especially at the senior high school (SMA) level, there is one very important subject, namely mathematics (Eliyah et al., 2018). Education is a dynamic activity to influence all aspects of personality and individual life, both cognitive, affective and psychomotor aspects (Suanarya, 2021). In the self-development of students, education plays an important role because education aims to build and develop the potential of students so that they have high abilities, skills and creativity. The role of education is also not only to develop the potential of students but is also expected to be able to develop the ability of students to solve problems in everyday life. In addition, education also plays an important role in educating the life of the nation, with education, people will gain knowledge so that they can improve the quality of human resources in Indonesia.

Mathematics is one of the basic sciences that is very important to be taught to students. Mathematics can also be interpreted as a means to think scientifically in developing logical abilities that are needed by students. In the development of science and technology (IPTEK), mathematics plays an important role because in learning mathematics it is required to think critically and carefully to manage information, solve a problem or problem so that it is useful both in everyday life and as a language or as the development of science and technology. (Lestari, 2018). In studying mathematics students are able to practice critical thinking so as to increase the level of students' mathematical reasoning abilities in learning mathematics.

One that is emphasized in learning mathematics is mathematical reasoning ability (Fanany et al., 2019). Good reasoning abilities are needed by students in the process of learning mathematics so that the learning process goes well and easily. This ability is the important aspect in learning mathematics because the mindset which is developed in mathematics requires and involves critical thinking, systematic, logical and creative (Isnani et al., 2019). This mathematical reasoning is characterized by several indicators as follows, (1) Being able to make conjectures (Conjucture), (2) Providing reasons or evidence for the truth of a statement, (3) Drawing conclusions from a statement (Himmi, 2017). In making decisions and actions to be carried out by students, it is influenced by Self Efficacy. Students who have a low level of Self-Efficacy will easily give up in facing problems, while students who have a high level of Self-Efficacy can help to create a sense of calm and confidence in facing problems.

The problem in the world of education in Indonesia today is the independence of students who are still unable to take the initiative without the help of other parties in deciding for themselves about learning, diagnosing learning needs, formulating learning objectives, identifying learning resources, selecting and implementing learning strategies and evaluating learning outcomes. . Another problem is that the learning model used by teachers in teaching is also still not appropriate, usually the learning model used by teachers in teaching always dominates the course of the learning process. Because of these problems, the quality of learning mathematics in Indonesia is still low and one of the reasons is that many students still think that mathematics is a difficult subject.

While the problem in learning mathematics is the low ability of students' mathematical reasoning in following mathematics lessons taught by the teacher in the classroom. In learning the teacher only explains the material and rarely gives exercises on problems in everyday life, this causes students to find it difficult to work on problems in everyday life. Most students in the class only listen to material from the teacher without providing feedback such as responses and questions to the teacher. Another problem is the low level of Self-Efficacy in learning at school, for example when the teacher gives a problem in everyday life and gives the task of presenting the answer in front of the class, many students don't want to come forward because they don't believe and are afraid of being wrong. with the answer. Therefore, students' beliefs about the subject being studied are very important in solving problems. Students should have strong beliefs about what they are doing (Haqqul et al., 2023).

The Self Direct Learning learning model can be used as the right model to use, where students take their own initiative to find answers and in the learning process students also identify their own teaching materials to be used in learning. The Self Direct Learning learning model cannot be interpreted as self-study because in self-study the teacher usually still provides teaching materials. The Self Direct Learning learning model is very suitable if you use the Student Centered Approach approach. The Student Centered Approach is a student-centered learning approach by looking at the learning processes and experiences that are regulated and controlled by the students themselves. Thus students decide for themselves about learning and find out for themselves what is considered important and useful.

Based on the results of observations and interviews with a mathematics teacher named Mr. Watro Puriyanto, S.Pd at SMA Negeri 5 Tegal, it was found that students experienced difficulties in learning mathematics because students did not yet have independence in terms of learning, the level of Self-Efficacy of students and mathematical reasoning abilities The low one. This can be said because during the observation, students showed a low level of Self-Efficacy in indicators according to Brown which refers to the dimensions of level, generality and strength, namely students are not sure they can carry out tasks properly, can survive in the face of difficulties and obstacles and can solve problems in all situations. Students also show low mathematical reasoning abilities in indicators according to Himmi, namely making conjectures, providing evidence of the truth and drawing conclusions from questions. In addition, the learning model used by the teacher is also less varied, making students feel bored and less interested in the learning that has been carried out so far. Students also still depend on the teacher in the sense that students only receive material from the teacher without any curiosity to find information on their own beyond the information that the teacher has conveyed in class. At the time of learning the teacher also helps too much so that students are less able to solve their problems independently. The material taken in this study is derived material. The reason for taking Derivative material is because this material is material after PAS and can be used to measure students' mathematical reasoning abilities. In Derivative material students have difficulty understanding concepts and material. This difficulty is that students make mistakes or difficulties in determining differentials or derivatives of algebraic functions (Wahyuni et al., 2023).

In connection with the existence of several problems in learning mathematics above, to improve the process of learning mathematics so that it is even better which will have an impact on student learning outcomes. Therefore, it is necessary to conduct research entitled "The Effectiveness of the Self Direct Learning Model with the Student Centered Approach Approach to Self Efficacy and Mathematical Reasoning Ability".

2. METHODOLOGY

The method in this research is Posttest-Only Control Design. Sugiyono (Sugiyono, 2017) stated that each of the two groups was selected randomly, with the first group being treated and the other group not. The group that is given the treatment is called the experimental group and the group that is not is called the control group. This study will compare the Self Efficacy and mathematical reasoning abilities of students who are taught with the Self Direct Learning learning model with the Student Centered Learning approach compared to using conventional models.

The population in this study were class XI students at SMA N 5 Tegal for the 2022/2023 academic year. Sampling using the Cluster Random Sampling technique. The samples taken were 105 students consisting of three classes. Data collection techniques used were interviews, documentation, questionnaires and tests. The research instruments were self-efficacy questionnaires and tests of students' mathematical reasoning abilities and were tested for validity and reliability at a significant level of 5%. Data analysis techniques used the proportion test, one sample t test, independent t test, manova test and hotelling τ^2 test which previously carried out prerequisite tests, namely the normality test and homogeneity test.

3. RESULTS

Before testing the hypothesis, first test the prerequisite hypothesis test which consists of a normality test and homogeneity test. This prerequisite test uses data on mathematical reasoning ability test scores and Self Efficacy questionnaire scores.

Following are the results of the normality test for the prerequisite hypothesis test:

Table 1. Normality test for the hypothesis prerequisite test

No	Variable	N	L_0	L_{table}	Conclusion
1	Mathematical Reasoning Ability	35	0,072	0,106	NORMAL
2	*Self Efficacy*	35	0,046	0,106	NORMAL

With the criterion area H_0 being rejected if $L_{count} > L_{table}$, then in other cases H_0 is accepted with a significance level of 5%. Based on table 1, $L_{count} < L_{table}$ is obtained. It can be concluded that H_0 is accepted and the sample comes from a normally distributed population.

Following are the results of the homogeneity test for the hypothesis prerequisite test:

Table 2. Homogeneity test for hypothesis prerequisite test

No	Variable	χ^2_{count}	χ^2_{table}	Conclusion
1	Mathematical Reasoning Ability	3,341	3,841	Homogeneous
2	*Self Efficacy*	7,39	7,82	Homogeneous

With the criterion area H_0 being rejected if $\chi^2 \geq \chi^2_{(1-\alpha)(k-1)}$, then in other cases H_0 is accepted with a significance level of 5%. Based on table 2, it is obtained because $\chi^2 < \chi^2_{table}$, then H_0 is accepted so the sample comes from a population that has a homogeneous diversity.

Following are the results of the proportion test in this study:

Table 3. Proportion Test

No	Variable	Z_{count}	Z_{table}	Conclusion
1	Mathematical Reasoning Ability	5,916	0,974	Beyond 50%

The hypothesis used for the proportion test is:

$H_0 : \rho \leq 50\%$, meaning that mathematical reasoning abilities and those taught using the Self Direct Learning model with the Student Centered Approach approach do not achieve completeness.

$H_1 : \rho > 50\%$, meaning that mathematical reasoning skills taught using the Self Direct Learning learning model with the Student Centered Approach approach achieve mastery.

H_0 is rejected if $z_{count} > z_{(0,05-\alpha)}$ and a significance level of 5%.

Through learning with the Self Direct Learning learning model it will provide a broader meaning for students in seeking experiences or new things that are used as new knowledge independently. In addition, students also have full responsibility in developing their own learning. With the independence possessed by students in the learning process it will form students to be more creative. As a result students will become more active, motivated and independent to seek knowledge.

Based on table 3 because $z_{count} > z_{table}$, it can be concluded that H_0 is rejected. So, the mathematical reasoning ability of students who are taught with the Self Direct Learning learning model with the Student Centered Approach approach in derived material whose value is ≥ 70 reaches 50%.

Then a one sample test was carried out with the following results:

Table 4. One Sample Test

No	Variable	Z_{count}	Z_{table}	Conclusion
1	Mathematical Reasoning Ability	25,897	1,697	H_0 is rejected

The hypothesis used for the one sample test is:

H_0 : $\rho \leq 70$, meaning that students who are taught using the Self Direct Learning learning model with the Student Centered Approach approach score not reaching 70.

H_1 : $\rho > 70$, meaning that students who are taught using the Self Direct Learning learning model with the Student Centered Approach approach score 70.

H_0 is rejected if $t_{count} > t_{(0,05-\alpha)}$ and a significance level of 5%.

Based on table 4, because $t_{count} > t_{table}$, it can be concluded that H_0 is rejected. So, students who are taught using the Self Direct Learning learning model with the Student Centered Approach approach score 70.

The right-sided t test is used to find out (1) Self Efficacy of students taught using the Self Direct Learning learning model with the Student Centered Approach approach is better than those taught using conventional learning models. (2) Mathematical reasoning abilities taught using the Self Direct Learning learning model with the Student Centered Approach approach are better than those taught using conventional learning models.

Following are the results of the right-sided t test for Self Efficacy of students who are taught using the Self Direct Learning learning model with the Student Centered Approach approach better than those taught using conventional learning models.

Table 5. Right-sided t test

No	T_{count}	T_{table}	Conclusion
1	4,200	1,645	H_0 is rejected

The hypothesis used for the right-sided t test is:

H_0 : $\rho_1 \leq \rho_2$, meaning that the Self Efficacy of students who are taught using the Self Direct Learning learning model with the Student Centered Approach approach is not better than those taught using conventional learning models.

H_1 : $\rho_1 > \rho_2$, meaning that the Self Efficacy of students taught using the Self Direct Learning learning model with the Student Centered Approach approach is better than those taught using conventional learning models.

H_0 is rejected if $t_{count} \geq t_{(1-\alpha),v(n_1+n_2-2)}$ with a significance level of 5%.

Self-efficacy or self-confidence is one of the factors that influence mathematical reasoning abilities because if students have confidence in themselves in doing assignments, then students will be easy and confident in expressing opinions in completing something that becomes their assignment.

Based on table 5, because $t_{count} \geq t_{table}$, it can be concluded that H_0 is rejected. So, the Self Direct Learning learning model with the Student Centered Approach approach is better than the conventional learning model for mathematical reasoning abilities in terms of students' Self Efficacy.

Following are the results of the right-sided t test for mathematical reasoning abilities taught using the Self Direct Learning learning model with the Student Centered Approach approach are better than those taught using conventional learning models.

Table 6. Right sided t test

No	T_{count}	T_{table}	Conclusion
1	6,253	1,645	H_0 is rejected

The hypothesis used for the right-sided t test is:

H_0 : $\rho_1 \leq \rho_2$, meaning that mathematical reasoning skills taught using the Self Direct Learning learning model with the Student Centered Approach approach are not better than those taught using

conventional learning models.

$H_1 : \rho_1 > \rho_2$, meaning that mathematical reasoning skills taught using the Self Direct Learning learning model with the Student Centered Approach approach are better than those taught using conventional learning models.

H_0 is rejected if $t_{count} \geq t_{(1-\alpha),v(n_1+n_2-2)}$ with a significance level of 5%.

Mathematical reasoning abilities in learning mathematics are also very important and must be considered so that educational goals can be achieved.

Based on table 6, because $t_{count} \geq t_{table}$, it can be concluded that H_0 is rejected. So, the Self Direct Learning learning model with the Student Centered Approach approach is better than conventional learning models for students' mathematical reasoning abilities.

The Manova test is used to determine whether there are differences in students' Self Efficacy and mathematical reasoning abilities taught using the Self Direct Learning learning model with the Student Centered Approach approach rather than conventional learning models.

Table 7. Manova test

No	λ_{count}	λ_{table}	Conclusion
1	0,198	3,92	H_0 is rejected

The hypothesis used for the Manova test is:

$H_0 : \rho_1 = \rho_2$, meaning that there is no difference in Self Efficacy of students and mathematical reasoning abilities taught using the Self Direct Learning learning model with the Student Centered Approach approach rather than conventional learning models.

$H_1 : \rho_1 \neq \rho_2$, meaning that there are differences in students' Self Efficacy and mathematical reasoning abilities taught using the Self Direct Learning learning model with the Student Centered Approach approach rather than conventional learning models.

If $\lambda >$ jika $U^a_{p,VH,VE}$ then H_0 is accepted and $\lambda \leq$ jika $U^a_{p,VH,VE}$ then H_0 is rejected with a significance level of 5%.

This is in line with Soemosasmito (2019) which says that a learning is said to be effective if it fulfills the main requirements, namely a high percentage of student learning time as outlined in the KBM, the average behavior of students in carrying out tasks such as developing class structures, provisions between teaching material and the ability of students or the orientation of student learning success is prioritized and develops an intimate and positive learning atmosphere.

Based on table 7 because $\lambda_{count} < \lambda_{table}$, it can be concluded that H0 is rejected. So, there are differences in students' Self Efficacy and mathematical reasoning abilities taught using the Self Direct Learning learning model with the Student Centered Approach approach rather than conventional learning models.

Because there are differences in students' Self Efficacy and mathematical reasoning abilities taught using the Self Direct Learning learning model with the Student Centered Approach approach rather than conventional learning models, it is continued with the Hotelling τ^2 test.

Table 8. Hotelling's τ^2 test

No	τ^2_{count}	τ^2_{table}	Conclusion
1	28,043	1,667	H_0 is rejected

The hypothesis used for the Hotelling τ^2 test is:

$H_0 : \rho_1 \leq \rho_2$, meaning that students' Self Efficacy and mathematical reasoning abilities taught using the Self Direct Learning learning model with the Student Centered Approach approach are not better than using conventional learning models.

$H_1 : \rho_1 > \rho_2$, meaning that students' Self Efficacy and mathematical reasoning abilities taught using the Self Direct Learning learning model with the Student Centered Approach approach are better than using conventional learning models.

H$_0$ is rejected if $\tau^2 > \tau^2_{\alpha;p;VE}$ and H$_0$ is accepted if $\tau^2 \leq \tau^2_{\alpha;p;VE}$ with a significance level of 5%.

Based on table 8, because τ^2count $> \tau^2$table, it can be concluded that H$_0$ is rejected. So, students' Self Efficacy and mathematical reasoning abilities taught using the Self Direct Learning learning model with the Student Centered Approach approach are better than using conventional learning models.

So based on the results of analysis of research data conducted at SMA N 5 Tegal on students in class XI Social Sciences for the 2022/2023 academic year, it is found that the Self Direct Learning learning model with the Student Centered Approach approach is effective for mathematical reasoning abilities in terms of students' Self Efficacy.

4. CONCLUSIONS

Based on the results of the analysis it can be concluded that: (1) Mathematical reasoning abilities taught using the Self Direct Learning learning model with the Student Centered Approach approach achieve mastery. (2) The Self Efficacy of students who are taught using the Self Direct Learning learning model with the Student Centered Approach approach is better than those taught using conventional learning models. (3) Mathematical reasoning abilities taught using the Self Direct Learning learning model with the Student Centered Approach approach are better than those taught using conventional learning models. (4) There are differences in students' Self Efficacy and mathematical reasoning abilities taught using the Self Direct Learning learning model with the Student Centered Approach approach rather than conventional learning models. (5) Students' Self Efficacy and mathematical reasoning abilities taught using the Self Direct Learning learning model with the Student Centered Approach approach are better than using conventional learning models.

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