

Discovery Learning to Develop Student Reflective Thinking Ability and Self-Efficacy

Mega Kusuma Listyotami¹, Sri Hastuti Noer², Een Yayah Haenilah³

^{1,2,3} Universitas Lampung

¹Correspondence Address; megakusumalistyotami@gmail.com

Abstract

The research and development aims to produce a discovery learning model that is oriented towards the student ability of reflective thinking and self-efficacy. The research was conducted using the Research & Development (R & D) method. The research and development model used refers to the procedure of R & D development by Gall and Borg by Sukmadinata that is ADDIE. The steps for implementing the research and development strategy include; (1) analysis, (2) design, (3) development, (4) implementation, (5) evaluation. The Data collecting methods and instruments are used tests and non-tests. The Data collection techniques using observation, interviews, questionnaires, and tests. The Data analysis techniques used in research and development are quantitative and qualitative descriptive. The results showed that the discovery learning model that was oriented towards the student ability of reflective thinking and self-efficacy was effective to improve the student ability of reflective thinking and self-efficacy respectively by 77% and 30%.

Keywords: Discovery Learning, Relative thinking, dan Self-Efficacy

INTRODUCTION

The Education is never separated from the learning process in learning activities. The Learning activities can take place as reflected by student activities (Yusuf, 2015). The student activity in the mathematics learning, which involves the process of thinking in every human being to achieve kinds of competencies, skills, and attitudes (Sani, 2016; Mentari, 2018). the Mathematics has an important role in various disciplines and develops the mindset of every human being (Somawati, 2018). The importance of mathematics in learning starts from elementary school to college. The Mathematics is important as means of developing the reasoning ability of thinking ability (Rasyid, 2017). The thinking skills that must be developed are the ability of thinking reflective and self-efficacy to achieve the success of the learning process (Setiani, 2017; Mentari, 2018). The Learning is good and successful if the factors influence of the learning system are mutually (Haryati, 2017). The success achievement of a learning is supported by optimal activity achievement with an atmosphere behaviour that supports the interesting learning process. The success of the learning process is also caused the teachers ability in developing learning models that are oriented towards increasing the intensity of the student effective involvement in the learning process. The weak of learning process is a lack of the teacher's supporting in pursuing the best learning process in developing students' thinking skills (Angkotasana, 2013). This means needs for applying good and appropriate learning models that involve the students actively (Baskara Putra, 2017). The Self efficacy influences the learning process, the teachers that have high self-efficacy be able to improve the quality of learning by showing good commitment to encourage the student achievement (Setiani, 2017). So it is important to choose the appropriate strategy by applying a learning model that is able to develop reflective thinking skills and self-efficacy, one of model learning is the discovery learning model.

Discovery learning is an based learning model that developed on constructivism theory, it emphasizes in the development of cognitive, affective, and psychomotor aspects in a balanced manner by requiring students to develop active learning by finding themselves and investigating themselves so that they can find their own concepts and theories of learning (Istikomah, 2013; Wardani UA, 2014; Yusuf M. d., 2015; Haryanti, 2016; Jalil, 2016; Rahayu, 2016; Fadriati, 2017; Late, 2017; Rosdiana, 2017; Sukmasari, 2017). The development of discovery learning models as an effort to assist teachers in overcoming student learning difficulties related to reflective thinking skills and self-efficacy. Discovery learning encourages the students to become active agents in their own learning processes. The teacher does not present to students directly in the learning, but the student must discover through experiments. The teacher only guides students to find two approaches about discovery learning, the first approach emphasizes the discovery of the learning process, the second approach focuses on developing knowledge. The reflective thinking process that means high-level thinking skills that are based on reason and purpose by involving problem solving, formulating conclusions and relating matters, and making decisions when someone uses meaningful and effective skills for a particular context and types of thinking assignmen (Ellianawati et al., 2014; Al Majid, 2015; Sani, 2016; Haryati, 2017; Rasyid, 2017; Mentari, 2018). It means that with the discovery knowledge actively in the students when the students reorganize their experiences based on students' cognitive knowledge and structure. The expectations and goals that need to be achieved by students for the ability to think reflectively in learning mathematics (Rasyid, 2017). The ability of mathematical reflective thinking needs to be supported by a didactic design by the teacher in the classroom (Nindiasari, 2016). Among the several indicators of ability that must be achieved so that optimal achievement in learning according to Noer (2010: 43-44) includes:

- a. Reacting is reacting with personal understanding of events, stimulation, or mathematical problems by focusing on the nature of the situation
- b. Comparing is analyzing and clarifying what individual experiences are believed by comparing reactions with other experiences, such as referring to a general principle or a theory.
- c. Contemplating is prioritizing deep personal understanding. In this case focus on a personal level in processes such as outlining, informing, considering and reconstructing a situation or problem.

Moreover, the ability of self-efficacy, the person must have confidence in the reflective thinking process. Reflection is broadly defined as active, persistent and belief. Belief in this case plays an important role because in reflection contains how the person can evaluate themselves. A person's evaluation of his ability or competence to perform a task, achieve goals, and overcome obstacles are definitions of self-efficacy. Self-efficacy is an important thing to have because it make students are motivated to learn through the use of self-regulation as a process of goal setting, self-evaluation, and setting strategies are used related to individual's assessment related own abilities as a result of cognitive processes in the form of decisions. beliefs, expectations about the extent of individuals estimate their abilities in doing tasks or

actions needed to achieve the results (Setiani, 2017; Isfayani, 2018; Putra et al., 2018; Masri, 2018). Students' self-efficacy and mathematical abilities also have a direct effect on students' mathematical performance. According to Noer (2012: 805), the aspects are used to measure self-efficacy include:

- a. The authentic mastery experiences, namely capability indicators based on performance on prior experience.
- b. The vicarious experiences, namely evidence based on competence and informative comparison with the results achieved by others.
- c. The verbal persuasion (verbal persuasions), which refers to direct feedback / words from the teacher or a more mature person.
- d. Psychological index, which is an assessment of abilities, strengths and weaknesses.

Regarding the benchmarks of ability to think reflective and self-efficacy, the development of research by applying the discovery learning model in learning. As for previous research and development that has used discovery learning models including: research and development affect the ability; understanding of science, science process skills, concept understanding, effectiveness and learning outcomes, improvement of concept understanding, and problem solving skills (Istikomah, 2013; Yusuf M. d., 2015; Haryanti, 2016; Rosdiana, 2017; Late, 2017; Sukmasari, 2017).

Based on the previous research, this research and development also applies the similar model, that is discovery learning model with renewal to find out how to produce discovery learning models that are oriented towards the student ability to thinking reflective and self-efficacy.

THE RESEARCH METHODS

i solve the mathematical problems. The test is used a test of students' reflective thinking ability with indicators; reacting, comparing, and contemplating. The questionnaire was used a self-efficacy questionnaire with 4 measurement aspect scales, these were performance achievement based on experience, other people's experiences, verbal persuasion, and psychology index. The data analysis techniques is used in research and development are quantitative and qualitative descriptive. The hypothesis of this research is the design of discovery learning models to develop the ability of reflective thinking and self-efficacy students meet the criteria of valid, practical, and effective in improving the ability of reflective thinking and student self-efficacy. The design of research and development design can be seen in Figure 1.

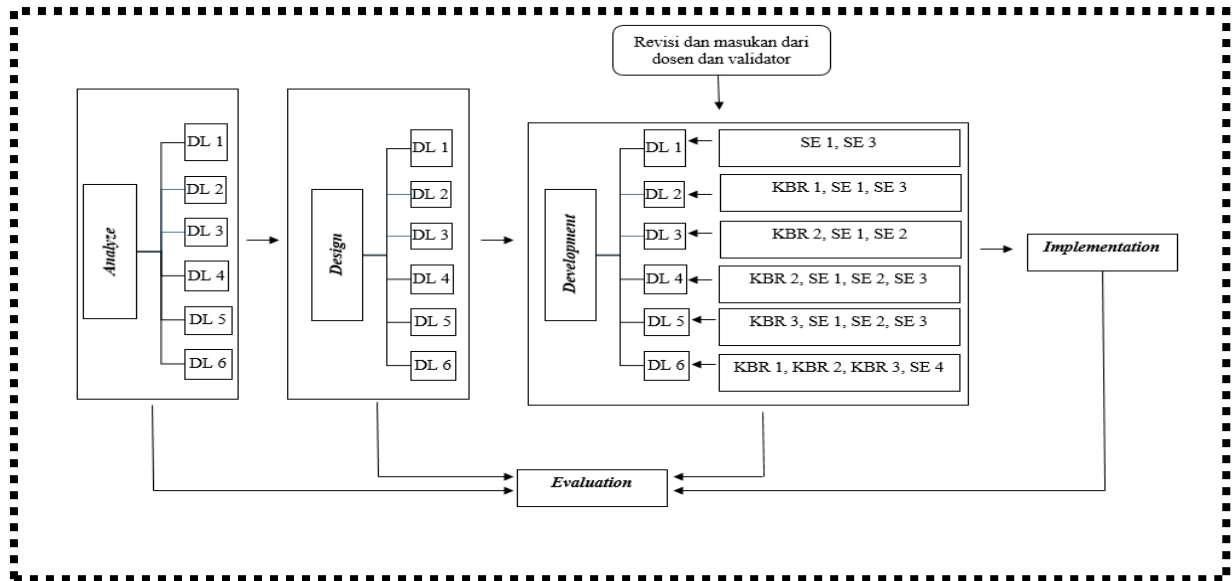


Figure 1. The research design and the development of Discovery Learning Model

The figure description :

- DL 1 : 1st Discovery Learning Phase
- DL 2 : 2nd Discovery Learning Phase
- DL 3 : 3rd Discovery Learning Phase
- DL 4 : 4th Discovery Learning Phase
- DL 5 : 5th Discovery Learning Phase
- DL 6 : 6th Discovery Learning Phase

- SE 1 : 1st Self-Efficacy Aspect
- SE 2 : 2nd Self-Efficacy Aspect
- SE 3 : 3rd Self-Efficacy Aspect
- SE 4 : 4th Self-Efficacy Aspect

- KBR 1 : Indicator of the 1st Reflective Thinking Ability
- KBR 2 : Indicator of the 2nd Reflective Thinking Ability
- KBR 3 : Indicator of the 3rd Reflective Thinking Ability

THE RESULTS OF THE RESEARCH AND THE DISCUSSION

The discovery learning design development model in this study research use the ADDIE learning design development model which stands for analysis, design, development, implementation, and evaluation. The stages in research and development include:

1. Analysis stage

In the learning mathematics identified several problems experienced by students, namely: (1) the student still difficulties in identifying contextual problems (daily life) into the form of mathematical models; (2) the student still difficulties in determining the strategies are used in answering math problems; (3) the student still difficulties in giving reasons for answers on the mathematical problem; (4) The student still difficulties to do the questions that require high-

level thinking skills. Some of the problems are faced by the students that are related to reflective thinking skills and student self-efficacy. The Problems experienced by students in learning mathematics have an impact on not optimal learning outcomes are obtained by students. Whereas in the school learning already use discovery learning models actively in accordance with the 2013 curriculum scientific approach, but its learning has not been effective enough to foster and maximize the ability of the reflective thinking and student self-efficacy.

2. Design Stage

After doing the analysis are known some problems , it is necessary to design appropriate to develop the ability of reflective thinking and self-efficacy of students through discovery learning models. It is necessary to add indicators of the ability of reflective thinking and aspects of self-efficacy of students in the stages of discovery learning models, which include: (1) in the first stage of stimulation was added to the self-efficacy aspect, (2) the second stage was performance achievement and self-efficacy aspects, (3) the third stage was verbal persuasion. But in the second stage problem identification was added with an indicator of the ability to reflect reflective; (1) first, namely reacting, self-efficacy aspects, (2) second, the performance achievement and self-efficacy aspect,(3) verbal persuasion. After that in the third stage of data collection (data collection) added reflective thinking ability indicators include; (1) the first, comparing, self-efficacy aspects, (2) The second, achievement of performance and aspects of self-efficacy, (3) The third, the experience of others. In the fourth stage of data processing (data processing) added reflective thinking ability indicators include; (1)the first, comparing, self-efficacy aspects, (2) the second, achievement of performance, aspects of self-efficacy, (3) the third, the experience of others, and aspects of self-efficacy, (4) the fourth, verbal persuasion. In the fifth stage of verification (verification) added a reflective thinking ability indicator includes; (1) the first, contemplating, self-efficacy aspects, (2) the second, achievement of performance, aspects of self-efficacy, (3) the third, the experience of others, and aspects of self-efficacy, (4)the fourth, verbal persuasion. In the sixth stage generalization for the test phase is added to the reflective thinking ability indicator including; (1) the first is reacting, (2) indicator of the second ability of reflective thinking is comparing, (3) indicators of the ability of the third reflective thinking is contemplating, (4) for the self-reflection stage, the self-efficacy aspect is a psychological index.

3. Development stages

After doing the design, it can be done development based on the discovery learning model step. There are 6 phases of discovery learning model that must be passed, while for self-efficacy aspects there are 4 phases with 3 reflective thinking ability indicators.

4. Implementation Stages

The implementation phase of discovery learning models to develop students' reflective thinking skills and self-efficacy are: (1) stimulation, the teacher gives the questions about the subject matter that has been studied by students relating to the material ; (2) problem statement, identifying problems by reacting using personal understanding. At the problem identification stage, the students identify problems by linking knowledge previously learned by students that relates to the material being studied by students; (3) the data collection, data collection begins

by utilizing the knowledge that has been owned by students previously and then searching literature and observing objects; (4) the data processing, data processing by analyzing and clarifying data that has been obtained at the data collection stage. Data processing using knowledge possessed by previous students. The data processing also uses individual experience in groups, the teacher helps students by giving feedback; (5) verification, proof by informing answers and reconstructing situations or problems; (6) generalization, the generalization stage is carried out by drawing conclusions with the knowledge that has been obtained by students, then a test is conducted to test students' reflective thinking skills and self-reflection to know the students' understanding in strengths and weaknesses and if there is a failure to find out where students fail

5. Evaluation Stages

The evaluation is carried out to determine whether the development achieved is in appropriate with the objectives. the evaluation at ADDIE stage is carried out by the researcher with guidance from the supervisor, then produces a product in the form of discovery learning oriented towards the ability to think reflective and self-efficacy of students.

The research was conducted to determine the effectiveness of the results towards the development of discovery learning models on the ability of reflective thinking and student self-efficacy. The results of the ability of students' initial reflective thinking were obtained from the results of the pretest scores conducted at the beginning of the meeting before learning was carried out. The recapitulation of the results of the pretest scores on students' initial reflective thinking skills is presented in Table 1.

Tabel 1. The Data on the Ability of Students' Initial Reflective Thinking

The Research Group	Amount of the student	The Average	Standard Deviation	The Lowest Value	The Highest Value
PDL	35	28,155	12,965	8,330	54,170
DL	35	29,644	10,405	8,330	50,000

Ideal Maximum Score = 100

Description:

- PDL = Discovery Learning Development
- DL = Discovery Learning
- Min = Minimum Value
- Max = Maksimum Value
- \bar{x} = Average
- s = Standard Divination

In the table 1, it can be seen that the average score of the initial reflective thinking ability of PDL class students is lower than the DL class students. The standard deviation in the DL class is lower than the PDL class. This shows that the distribution of scores on the ability to think reflective early in PDL class students is more heterogeneous than DL class students. The minimum score obtained by students in the PDL class is the same as the minimum score obtained by students in the DL class. While the maximum score obtained by students in the PDL class is lower than the DL class students. The final reflective thinking ability data was

obtained from the posttest results that is conducted after the learning was done. The recapitulation of the results of the posttest score on the final mathematical reflective thinking ability is presented in Table 2.

Tabel 2. The data on Students' Final Reflective Thinking Ability

Group Research	Amount of Student	Average	Standard Deviation	The lowest Value	The Highest Value
PDL	35	83,571	5,931	72,917	97,917
DL	35	75,477	7,796	54,167	87,500

Ideal Maximum Score = 100

Description:

- PDL = Discovery Learning Development
- DL = Discovery Learning
- Min = Minimum Value
- Max = Maximum Value
- \bar{x} = Average
- s = Standard Deviation

In Table 2, it can be seen that the average score of students' ability on thinking reflective in the PDL class is higher than the DL class. The highest score in the PDL class was higher than the highest score in the DL class and the lowest score in the PDL class was higher than the lowest score of the DL class. The standard deviation of the PDL class is lower than the standard deviation of the DL class. This shows that the distribution of scores of students' ability in thinking reflective in the DL class is more heterogeneous than the PDL class. After the pretest and posttest were obtained the initial score and final score data were then processed to get the data gain of reflective thinking ability and student self-efficacy. Data recapitulation of the ability of students to reflect reflective thinking following the PDL model and DL learning is presented in Table 3.

Tabel 3. The Gain data of Students' Reflective Thinking Ability

No	Class	Value	N	Xmin	Xmaks	\bar{x}	N-gain Average
1	PDL	Pretest	35	8,33	54,17	28,15	0,77
		Posttest		72,91	97,91	83,57	
2	DL	Pretest	35	8,33	50,00	29,64	0,65
		Posttest		54,16	87,50	75,47	

Ideal Maximum Score = 100

Description:

- PDL = Discovery Learning Development
- DL = Discovery Learning
- Min = Minimum Value
- Max = Maximum Value
- \bar{x} = Average
- s = Standard Deviation

In Table 3, it can be seen that the average gain index of reflective thinking students that use the development of discovery learning is higher than the average gain index of reflective thinking students that use the discovery learning. Based on Table 3 the average gain index of the experimental class is 0.77, this means that the improvement of students' reflective thinking skills using the development of discovery learning is included in the improvement with high criteria. While the improvement of students' reflective thinking ability using discovery learning is included in the improvement with the medium criteria with the average gain index of the control class that is equal to 0.65. The Primary data of the students' self-efficacy were obtained from the scale scores conducted at the beginning of the meeting before learning was conducted. The recapitulation of The Primary Data of the scale scores result of students' self-efficacy is presented in Table 4.

Tabel 4. The Primary Data of Self-efficacy Student

Group Research	Amount of Student	Average	Standard Divination	The Lowest Value	The Highest Value
PDL	35	80,486	7,278	68	96
DL	35	81,629	6,778	66	97

Ideal Maximum Score = 100

Description:

PDL = Discovery Learning Development

DL = Discovery Learning

Min = Minimum Value

Max = Maximum Value

\bar{x} = Average

s = Standard Divination

Based on Table 4 it can be seen that the Primary average self-efficacy score of students in PDL class is lower than the DL class. The standard deviation of The primary students' self-efficacy data in the PDL class is higher than the DL class. This shows that the distribution of The primary students' self-efficacy scores in the PDL class is more heterogeneous than the DL class. The final student self-efficacy data in the PDL class and DL class were obtained from the score of the self-efficacy scale carried out at the end of the meeting. The recapitulation of the final student self-efficacy scale scores is presented in Table 5.

Tabel 5. The Final Data of Self -Efficacy Student

Group Research	Amount of Student	Average	Standard Divination	The Lowest Value	The Highest Value
PDL	35	111,486	3,128	104	119
DL	35	98,371	3,326	89	104

Ideal Maximum Score = 100

Description:

PDL = Discovery Learning Development

DL = Discovery Learning

Min = Minimum Value

Max = Maximum Value
 \bar{x} = Rata-Rata Average
 s = Standard Divination

Table 5 Shows that The Final average Score of Self-efficiency Student in the PDL class is Higher than The DL Class. The Standard Divination of the Self-efficiency student final score is Lower than DL Class. The Standard Divination of The standard deviation of the students' final self-efficacy in the PDL class is lower than the DL class. This shows the final self-efficacy score of DL class students is more heterogeneous than PDL class. The recapitulation of data on gain self-efficacy of students participating in PDL and DL is presented in Table 6.

Tabel 6. The Data of GainSelf-Efficacy Student

No	Class	Value	N	Xmin	Xmaks	\bar{x}	N-gain Average
1	PDL	Pretest	35	68	96	80,48	0,52
		Posttest		104	119	111,48	
2	DL	Pretest	35	66	97	81,62	0,28
		Posttest		89	104	98,37	

Ideal Maximum Score= 140

Keterangan:

PDL = Discovery Learning Development
 DL = Discovery Learning
 Min = Minimum Value
 Max = Maximum Value
 \bar{x} = Average
 s = Standard Divination

Based on Table 6 shows that the average gain self-efficacy index of students who use the development of discovery learning is higher than the average gain self-efficacy index of students who use discovery learning. Based on Table 6 the average gain index for the experimental class is 0.52. This means that the increase in students' self-efficacy ability using the development of discovery learning is included in the the medium criteria, while the increase in students' self-efficacy using discovery learning is included the low criterion with a mean gain class control index of 0.28.

This means that the design of discovery learning models is effective to develop the student reflective thinking skills and self-efficacy. The research and development that encourages to improve the quality of teaching and learning in the classroom. The implementation of the discovery learning model must be balanced with the teacher's ability. The existence of training for the teacher about discovery learning can improve the teacher ability to carry out classroom learning (Rahayu, 2016). The teacher ability strongly influences the quality of learning outcomes, therefore the teacher must be more ready in preparing the learning model strategy. Basically The students' thinking ability, especially the ability to think reflective has a relationship with the ability of self-efficacy so that students who have good reflective thinking ability will have high self-efficacy be able to solve mathematical problems in order to obtain

the appropriate results so that the student can be achieved the best quality of learning (Astutiningrum, 2016; Masri, 2018; Putra et.al., 2018).

CONCLUSION AND SUGGESTION

As the results of the research and development that were carried out, it can be concluded that the design of discovery learning models is effective for developing students' reflective thinking skills and self-efficacy. Based on the conclusions above there are some suggestions including: for further research can look for other learning models that are more influential on the ability of reflective thinking and self-efficacy of students and try to use the similiar model or other learning models by looking for the other influences or adding a review research on students' knowledge, affective, and psychomotor abilities. Hopefully this research can be useful and be a source of reference to further research.

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