The analysis of research-based learning implementation and its affect to the students’ metacognition skill in solving a resolving domination number of a graph

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Abstract. Students are expected to be able to maximize metacognition skills by implementing research-based learning. This research aims to investigate the analysis of mathematics learning application implementation based on research-based learning and the influence on students’ metacognition skills in solving resolving domination number problems in the graph. The method used in the research is a mixed-method that is combining the qualitative and quantitative methods. The research subject is the 3rd semester students consisting of 41 experimental class students and 31 control class students. Both classes are given different treatments. The instruments of this research are the test, observation, and interview. The qualitative method is used to analyze the difference between students’ learning result between two classes, while the qualitative method is applied to analyze students’ metacognition skills. The research results show that there is a significant difference between both classes implementing research-based learning and conventional learning model. The statistic result shows that the 2-tailed significance of independent sample t-test within the post-test is 0.000 or α ≤ 0.05. It shows that the implementation of research-based learning significantly affects students’ metacognition skills in solving resolving domination number problems. Based on the results of the portrait phase analysis, it is known that students in the experimental class have relatively good metacognition skills compared to the control class. This can be seen from the number of indicators that can be mastered by each student.

1. Introduction

Education is one of the main factors in the development of a country, especially education on the university level, it is due to the higher education or on the university level has a strategic role in increasing the quality of Human Resources (HR). The very rapid development of science, technology, and art brings the consequences of human resource management that has the ability in innovating. Therefore, education is recently demanded to be able to grow and develop all of the existing skills in learners. One of the learners’ skills expected to be improved through the education process is metacognition skills.

The term of metacognition was firstly introduced by [1]. Flavell interpreted metacognition as thinking about thinking or the knowledge someone has about someone's thinking process. Metacognition is also interpreted as a mind ability to monitor and control the cognitive or in other words
cognitive is the ability to know about our knowledge [2, 3, 4]. Metacognition is divided into two components, that are metacognitive knowledge and experience or metacognitive regulation [1, 4].

Essential metacognitive skills for each efficient problem-solving consist of the ability in: (1) planning, that is result estimation, and scheduling strategy (2) monitoring, that is testing, revision, and rescheduling strategy that is done, and (3) examination, that is the result evaluation from the implementation of a strategy based on efficiency and effectiveness criteria [5]. In line with the view above, Cohors-Fresenborg & Kaune in [6], grouped metacognition skills in solving problems consisting of (1) planning, (2) monitoring, and (3) reflection. The implementation of these metacognition activities is very determined by the student's awareness of the knowledge they have related to the problems being solved and how to measure the awareness in solving problems. The following is the indicator of the metacognition skills used in this research.

| Table 1. Indicator of metacognition skills |
|-------------------------------------------|
| **Planning**                              |
| a. Read and outline the problems          |
| b. Can predict problem-solving plan       |
| c. Can get the problem-solving plan       |
| d. Able to involve previous knowledge in solving problems |
| **Monitoring**                            |
| a. Believe problem-solving plan chosen is correct |
| b. Do the right work steps                |
| c. Examine the correctness of the steps   |
| d. Able to set the result                |
| **Examination**                           |
| a. Crosscheck the work                    |
| b. Can determine with different ways      |
| c. Can apply this method for other questions |
| d. Notice own ways of work               |
| e. Evaluate achievement of objectives     |

Every student has different abilities in solving problems. This is because of the different awareness levels or metacognitive levels. As for someone's awareness level in thinking process according to Swartz and Perkins [7, 8, 9] covers tacit use, aware use, strategic use, and reflective use. Fogarty [8, 9, 10] argued that metacognition controls the cognitive process. High ability student has a level of reflective use and maybe also strategic use. Moderate ability student has a level of strategic use and maybe also aware use. Low ability student has a level of aware use and maybe also tacit use. However, sometimes it's not like that. This is because of several factors such as the condition in the process of solving problems.

One of the learning model as the alternative in increasing students’ metacognition skills is by implementing RBL model. Dafik stated that RBL is a learning model that makes problems in the research group as the main discussion in the lecture [11]. Based on [12, 13] RBL is a research-based learning model that aims to support the development of higher-order thinking skills from the lecturer and students. The same thing is also expressed by [13, 14, 22] stating that RBL is a learning method involving the learning of contextual, learning of authentic, problem-solving, learning of cooperative, learning of practical, and inquiry discovery approach.

According to [11, 15], some strategies in integrating research in learning among others are (1) enriching teaching materials with the lecturer's research results, (2) using advanced research discoveries and tracking the origin history of the discoveries, (3) learning activities enriched with contemporary research problems, (4) teaching research methodology material within the learning process, (5) small-scale research activities to enrich the learning process, (6) students are involved in activities to enrich the learning process, (7) applying cooperative teaching and learning in the learning by encouraging learners to interact actively, and (8) Researchers have values that can enrich the learning process.

The aim of this research is to analyze the implementation of RBL model and the effect on students’ metacognition skills in solving resolving domination number problems in the graph and this research is
close to some research like the research by [17]. This research is new because it focuses on the students' metacognition skills in solving resolving domination numbers in graphs. Data are obtained from student worksheets and post-test. Student worksheets used are worksheets that have been designed as the indicator of metacognition skills.

The diagram of the implementation steps of research-based learning [11, 12, 13, 16, 17] and [18] can be seen in Figure 1.

Figure 1. The diagram of the implementation steps of RBL

This research aims to find out the implementation of research-based learning and the influence on students’ metacognition skills in solving resolving domination number. The concept of resolving domination number was firstly introduced by [19]. The resolving domination number is the combination from the review of domination number and metric dimension. The resolving domination number is minimum cardinality from a resolving dominating set. The resolving domination number is notated by $\gamma_r(G)$ and has the requirement of domination number and has metric dimension condition. In the research, students are asked to find the resolving domination number in the graph based on the definition and RBL steps.

2. Research method
The method used in this research is a mixed-method that is combining between the qualitative and quantitative approaches [11, 12, 13, 14, 16, 17, 18] and [20] also use the mixed-method in the research. In this research, quantitative data is the main data obtained from the compiled test based on the indicator of students’ metacognition skills in solving resolving domination number problems in the graph. While qualitative data is supporting data obtained from students’ interview results to picture the portrait phase of students’ thinking. The subject of this research is the 3rd-semester students of Mathematics Education study program, University of Jember. This research uses 2 classes that are class C as the control class consisting of 31 students and class B as the experimental class consisting of 41 students. Then, both classes are given pre-test and post-test that have been compiled based on the indicator of metacognition skills.

The research design used has the form of a non-equivalent control group design. Both groups are given different treatments. Conventional learning method will be applied in the control class and research-based learning will be applied and student's worksheets will be used in the experimental class
Table 2. The scheme of experimental design

| Class    | Pre-test | Treatment                           | Post-test |
|----------|----------|-------------------------------------|-----------|
| Experimental | $O_1$    | RBL and Students’ Worksheets         | $O_2$     |
| Control  | $O_3$    | -                                   | $O_4$     |

In this research, the population is the 3rd-semester students of mathematics education study program faculty of teacher training and education science University of Jember. The research sample is taken from two classes randomly that are the control class with 31 students and the experimental class with 41 students. In the experimental class, the implementation of research-based learning is given, and the control class with the implementation of conventional learning.

In this research, the instrument used was a test consisting of pre-test and post-test, observation, and interview. The rating scale on the test uses 0-100 intervals. Meanwhile, the observation and interview sheets have 0-4 assessment intervals that have been validated by experts. This study consists of three stages in accordance with the stages in the research design, namely: preliminary studies (qualitative research), analysis of students’ metacognition skills and application of research-based learning (quantitative research), portrait phase (qualitative research). A description of the research procedure is illustrated in the following diagram.

![Diagram of mixed-method flow model](image-url)
Tasks given to the students are pre-test, post-test, and students’ worksheets arranged according to the indicator to measure students’ metacognition skills. The control class and the experimental class were given the same test, while the student worksheets were only given to the experimental class. Students are asked to find the dominating point, point representation and resolving domination number form the graph. The tasks given to the students are as follows:

The following figure is the label or notation giving on the $P_6$ path graph.

The following is the point determination that is dominating and also as the generator on the $P_6$ path graph.

The following is the point determination on the $P_6$ graph.

The image beside has fulfilled the requirement of resolving domination that is having a dominating and metric dimension so that $\gamma_r(P_6) = \left\lceil \frac{n}{3} \right\rceil$

**Figure 3.** The example of the resolving domination on the path graph ($P_6$)

From the graph above, the first step is giving the label of point and edge. After that, we determine the cardinality of point and edge. The next step is determining a point that is dominating another point and the distance representation. This task aims to make the students understand about the resolving domination number in the graph.

In this research, quantitative data is obtained from the experimental results in the control class and the experimental class, which is then analyzed using an independent t-test with the help of SPSS. While qualitative data is obtained from the interview and observation results analyzed in the form of a portrait phase. Besides, qualitative data and quantitative data are also analyzed using descriptive and inferential statistics. To compare the experimental class and the control class using an independent sample t-test with a significance value of 0.05.

3. **Research finding**

The qualitative method in this research was used to find out students’ metacognition skills in the experimental class and control class. The research in the experimental class and the control class were carried out after the research instrument was tested with validity test and reliability test. Then students are given a pre-test in the experimental class and the control class to find out the initial ability of metacognition skills.

After doing the pre-test in the control class and experimental class, the learning in both classes would be done with details that the experimental class used a research-based learning model and the control class used conventional learning. After applying the learning model in both classes, the next step was given the post-test to find out the final initial of students’ metacognition skills. Then, the result of both classes would be analyzed using SPSS application and Microsoft Excel. The following is the result of data analysis using SPSS application and Microsoft Excel.

3.1. **Validation and reliability**

Before showing the result, it is necessary to test the validity and reliability of the post-test instrument. The instrument is considered as valid and reliable if $t\text{-count} \geq r\text{-table}$ (Testing 2-edges with sig. 0.05) with degrees of freedom (df) N-2. The following table shows the result of the validity and reliability of the post-test instrument.
Table 3. The testing result of validity of post-test instrument correlations

| Problems | Pearson Correlation | Sig. (2-tailed) | N  |
|----------|---------------------|-----------------|----|
| Problems 1 | 1                   | .327*           | 41 |
|          |                     | .037            | 41 |
|          |                     | .073            | 41 |
|          |                     | .183            | 41 |
|          |                     | .201            | 41 |
| Problems 2 | .327*               | 1               | 41 |
|          |                     | .191            | 41 |
|          |                     | .130            | 41 |
|          |                     | .208            | 41 |
| Problems 3 | .208                | .253            | 41 |
|          |                     | .066            | 41 |
|          |                     | .008            | 41 |
|          |                     | .083            | 41 |
| Problems 4 | -.050               | 1               | 41 |
|          |                     | .011            | 41 |
|          |                     | .253            | 41 |
| Problems 5 | -.078               | .183            | 41 |
|          |                     | .011            | 41 |
| Totals   | .304                |                | 41 |
|          |                     |                | 41 |
|          |                     |                | 41 |
|          |                     |                | 41 |

Based on table 3, it can be seen that the value of $r_{count}$ from the problem 1 = 0.304, problem 2 = 0.487, problem 3 = 0.839, problem 4 = 0.729, and problem 5 = 0.441. All items produce the value of $r_{count} > r_{table}$ (0.2605) with df = N - 2 = 39 so that all items are valid.

Table 4. The testing result of reliability of post-test instrument

| Cronbach's Alpha | N of Items |
|------------------|------------|
| .518             | 5          |

Based on table 4, it can be seen that the whole reliability values are 0.518. $r_{table}$ with the significance of 5% and df = N - 2 = 39 is 0.2605, because $r_{count}$ (0.518) > $r_{table}$ (0.2605) it can be concluded that the post-test instrument is reliable. Because the instrument is reliable and valid, so the next step is to implement the instrument in the experimental class and control class.

3.2. Result

The research began with a pre-test of 31 students in the control class to determine the level of metacognition skills. Based on the pre-test results in the control class (diagram 1), it was found that 19% of students were in the very good category in metacognition skills, 28% of students were in the good category in metacognition skills and 53% of students are in the poorly category in metacognition skills. Student pre-test results in the control class are depicted in diagram form as follows.
Next is a pre-test was tested on 41 students in the experimental class to determine the student's initial ability in metacognition skills. Based on the results of the pre-test in the experimental class (diagram 2), it was found that 22% of students in the very good category in metacognition skills, 30% of students were in the good category in metacognition skills and 48% of students were in the poorly category in metacognition skills. Student pre-test results in the experimental class are depicted in the form of a diagram as follows.

Pre-test results data obtained from the experimental class and the control class were further analyzed using SPSS version 17.0 in the form of homogeneity test, normality test and independent t-test test. The homogeneity test aims to determine whether the variance in the control class and experimental class are different or the same. Normality test aims to determine whether the distribution of pre-test data in the experimental class and the control class are normally distributed or not. whereas independent t-test aims to find out the difference in the mean of the data that is independent of the experimental class and the control class. In this research, the data is said to be homogeneity if the significance value or Sig. > 0.05.

| Very Good | Good | Poorly |
|-----------|------|--------|
| Planning  | 9    | 12     |
| Monitoring| 8    | 15     |
| Evaluating| 10   | 10     | 21    |

Based on table 5, the homogeneity test pre-test in the control class and the experimental class get sig values 0.905. This is significant and greater than 0.05 (0.905> 0.05), so the variance of pre-test data from the experimental class and the control class is Homogen. The next data analysis is the normality test.

Table 5. The testing result of pre-homogeneity test

| Levene Statistic | df1 | df2 | Sig.  |
|------------------|-----|-----|-------|
| .014             | 1   | 70  | .905  |
Table 6. The testing result of pre-normality test

| Group          | Kolmogorov-Smirnov | Shapiro-Wilk |
|----------------|--------------------|--------------|
|                | Statistic | df | Sig. | Statistic | df | Sig. |
| Pre Test       |           |    |      |           |    |      |
| Experimental   | .122      | 41 | .126 | .955      | 41 | .109 |
| Control Class  | .107      | 31 | .200 | .944      | 31 | .104 |

Based on table 6, the value of the experimental class kolmogorov-Smirnov is 0.126 ≥ 0.05 and the value of the control class Kolmogorov-Smirnov is 0.200 ≥ 0.05. So it can be concluded that the experimental class and control class data are normally distributed. The next data analysis is an independent t-test using the SPSS application with learning outcomes data from the pre-test.

Table 7. The average testing result of pre-test

| Group          | N  | Mean   | Std. Deviation | Std. Error Mean |
|----------------|----|--------|----------------|-----------------|
| Pre-Test       |    |        |                |                 |
| Experimental   | 41 | 60.4390| 8.79502        | 1.37355         |
| Control Class  | 31 | 57.5806| 8.76270        | 1.57383         |

Based on Table 7 the statistical test results show that the average of each control class group is 57.5806 and the experimental class is 60.4390. These results indicate that the average control class is lower and the experimental class is higher. Then the next analysis is the analysis of independent test results in both classes. In this study, the results are said to be significant if the Sig. (2-tailed) is greater than 0.05.

Table 8. The testing result of pre-independent test

| Levene's Test for Equality of Variances | t-test for Equality of Means |
|----------------------------------------|-----------------------------|
|                                        | 95% Confidence Interval of the Difference |
| F           | Sig. | t     | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper     |
| Pre-Test Equal variances assumed        | .014  | .905  | 1,368 | .176 | 2.85838 | 2.09000 | -1.31000 | 7.02676 |
| Equal variances not assumed             | 1,368 | 64,877| .176 | 2.85838 | 2.08892 | -1.31363 | 7.03039 |

Based on table 8, the value of Sig. (2-tailed) is 0.176 > 0.05, then Ho is accepted, which means there is no significant difference in the average pretest value of the control class and the experimental class.

The research was then continued by carrying out learning using conventional learning models in the control class and research-based learning models in the experimental class then continued with the post-test at the end of the learning. Based on the results of research conducted in the control class of 31 students after a post-test, it was found that 56% of students in the very good category in metacognitive skills, 29% of students were in the good category in metacognition skills and 15 % of students are in the poorly category in metacognitive skills. The results of the student post-test in the control class are depicted in diagram 3 as follows.
Diagram 3. Post-test distribution of students’ metacognition skills in the control class.

Furthermore, a post-test was conducted on 41 students in the experimental class to find out the students' metacognition skills after applying research-based learning. Based on the post-test results, it was found that 67% of students were in the very good category in metacognitive skills, 23% of students were in the good category in metacognitive skills and 10% were in the poorly category in metacognition skills. Student post-test results in the experimental class are depicted in diagram 4 as follows.

Diagram 4. Post-test distribution of students’ metacognition skills in the experimental class

After learning in the experimental class with research-based learning methods and control classes with conventional methods, the data obtained from the post-test results are further analyzed using the normality test and independent test. Normality test aims to determine whether the distribution of post test data in the experimental class and the control class are normally distributed or not. In this study, the data distribution will be said to be significant if the value is greater or equal to 0.05.

Table 9. The testing result of post-normality test

| Group         | Kolmogorov-Smirnov | Shapiro-Wilk |
|---------------|--------------------|--------------|
|               | Statistic  | df   | Sig. | Statistic  | df   | Sig. |
| Post-Test     |           |      |     |            |      |     |
| Experimental Class | .112    | 41   | .200 | .950       | 41   | .070 |
| Control Class | .104     | 31   | .200 | .968       | 31   | .465 |

Based on table 9, the value of the experimental class kolmogorov-Smirnov is 0.200 ≥ 0.05 and the value of the control class Kolmogorov-Smirnov is 0.200 ≥ 0.05. So it can be concluded that the experimental class and control class data are normally distributed. The next data analysis is an independent t-test using the SPSS application with learning outcomes data from the post-test.
Based on Table 10 the statistical test results show that the average of each control class group is 70.3548 and the experimental class is 72.9765. These results indicate that the average control class is lower and the experimental class is higher. Then the next analysis is the analysis of independent test results in both classes. In this study, the results are said to be significant if the Sig. (2-tailed) is greater than 0.05.

The testing result of Post-Test in the control class and experimental class in table 11 shows that the Sig. value (2-tailed) is 0.024 < 0.05, then Ho is rejected, meaning that there is a significant difference in the average value of the post-test from the control class and experimental class.

The next analysis is a research-based learning analysis conducted in the experimental class observations. Based on Diagram 5, it was found that 57% of students were very active in research-based learning, 26% of students were active in research-based learning, 12% of students were quite active in research-based learning, 4% of students were not active in research-based learning, and 1% of students were very active not active in research-based learning. So the RBL can give effect to work in solving the problem of resolving domination number. The results of observations from the research-based learning in the class experiment are described in the form of a diagram as follows.
3.3. Portrait Phase

Portrait phase is obtained to draw a picture of students’ thinking skill process. 3 subjects were chosen from the experimental class and control class according to the post-test result. The interview was done in the determined subject to find out metacognition thinking skills in solving resolving domination number.

![Graph](image)

Figure 4. The work result of student 1 (very good)

The analysis of student results depicted in the portrait of this phase is carried out to support the information provided by students in interviews in accordance with their work. The results of student 1 in determining the resolving domination number in a graph can be seen in Figure 4. Student 1 gave the label on each point with the label of $x_1, x_2, x_3, x_4, y_1, y_2, y_3$ and $y_4$. Then, the subject found the cardinality of point and edge and finds a dominating point as well as the point representation in the graph.

After the student solved the problem related to resolving the domination number in the graph, the researcher interviewed a mind map in solving problems about the resolving domination number. This interview aims to find out the students’ mindset when solving resolving domination number problems.

The interview results in subject 1.

Researcher : After reading and describing this problem, what do you understand? Or what is the first thing that comes to mind?

Student : What first appeared is solve an easy problem, that is cardinality and to label in the graph.

Researcher : Can you predict the solution to the problem?

Student : Yes, sir.

Researcher : Did you get a settlement plan that can help you solve the Resolving domination problem in the graph?

Student : Yes, Sir. Based on the material that you explained before

Researcher : What knowledge do you use to solve resolving the domination of the problem in graphs?

Student : The prior knowledge that I used was material dominating set and metric dimensions. I involve that knowledge, so that I can easily resolve resolving domination

Researcher : Are you sure about the settlement plan you made?

Student : Yes, I am sure

Researcher : Are you doing the right steps?

Student : Yes, sir

Researcher : Did you double-check the steps you took?

Student : Yes sir, I recheck my work as you demonstrated

Researcher : How do you manage your work?

Student : Following the steps of the process, as explained by the Ser before

Researcher : Do you double check the workmanship that you do as a whole?
Student : Yes, Sir
Researcher : Did you find a different way to resolve Resolving domination or a different result?
Student : I found the minimum cardinality of the graph that I worked on
Researcher : Can the method you use to be applied to other problems?
Student : Yes, Sir
Researcher : What do you think about your workings in resolving the Resolving domination problem in graphs?
Student : I am happy because I can do it well, although there are still shortcomings.

Figure 5. Portrait phase of metacognition skills of student 1

Figure 5 shows students’ thinking process in solving problems, related to the resolving domination number in the graph. From Figure 5 shows that student 1 has a repetition at stage A4 returning to A3, repetition at stage A3 returns to A3, repetition at stage B4 returns to B3 and at stage B3 directly jumps to C1.

The interview results in subject 2.
Researcher : After reading and describing this problem, what do you understand? Or what is the first thing that comes to mind?
Student : What I understand is looking for the cardinality of the graph and looking for resolving domination of the graph
Researcher : Can you predict the solution to the problem?
Student : Yes sir
Researcher : Did you get a settlement plan that can help you solve the Resolving domination problem in the graph?
Student : Yes sir
Researcher : What knowledge do you use to solve resolving the domination of the problem in graphs?
Student : The dominating set material and metric dimensions that you have explained
Researcher : Are you sure about the settlement plan you made?
Student : Yes, I am sure because it was explained by the previous Sir
Researcher : Are you doing the right steps?
Student : Yes
Researcher : Did you double-check the steps you took?
Student : No
Researcher : How do you manage your work?
Student: As stated by the you
Researcher: Do you double check the workmanship that you do as a whole?
Student: No
Researcher: Did you find a different way to resolve Resolving domination or a different result?
Student: No
Researcher: can the method you use to be applied to other problems?
Student: Yes, sir, but I didn't try it
Researcher: What do you think about your workings in resolving the Resolving domination problem in graphs?
Student: I am happy to be able to solve it

![Figure 6. The work result of student 2 (good)](image)

According to Figure 7, student 2 showed that student 2 did a repetition on the A4 stage to the Ia, the Id to the A3. In stage B2, jump directly to stage C3.

![Figure 7. Portrait phase of metacognition skills of student 2](image)

Figure 8 is the combination of the portrait phase from students 1 and student. The combination of the portrait phase on metacognition skills is how the students think globally, they have their way of solving a problem.
4. Discussion

This research was conducted to analyze the implementation of research-based learning and the influence on students’ metacognition skills in solving resolving domination number problems in the graph. The research finding shows that the research done in the experimental class shows the significance of students' metacognition skills that can be seen on the post-test result. Research finding also shows that the implementation of research-based learning has a significant effect on the increase of students’ metacognition skills. It shows that students’ metacognition skills on the control class are very good of 56%, good of 29%, and poorly of 15%, while the experimental class shows very good of 67%, good of 23%, and poorly of 10%. From these results, it can be concluded that students in the experimental class show their higher metacognition skills than in the control class.

The result of the independent test obtains the value of sig. (2-tailed) 0.024 ≤ 0.05. It can be concluded that the post-test result between the control class and experimental class has a significant difference after research-based learning is applied. This is in line with the result of the research that was done by [11, 12, 16, 17,18] and [22]. Because the steps of this RBL learning model emphasize on the student-centered learning and lecturer as the mentor in directing students to solve problems they face, students were encouraged to identify the problem and developed strategy of problem-solving based on the experimental experience and literature study, it implies that students’ thinking is always consistently active in solving problems given. Research-based learning has to be applied in many departments to enlarge the research in all institutions and to implement the research in education, the relationship between the research and learning [21].

Based on the research that has been done, the implementation of RBL has a significant effect on students’ metacognition skills in the experimental class. The research results show the increase in students’ learning results and metacognition skills seen from the post-test they have done. Data obtained through the observation process revealed that the students give positive responses. The highest score of observation criteria reaches 57%. It shows that, during the implementation of RBL, students are actively involved in solving problems, and 26% of students reached the active level, and the rest of all are 12% fair, 4% poor, and 1% very poor. It can be concluded that RBL can contribute positively to the process of learning and increases students’ metacognition skills.

Portrait phase is a picture of students’ thinking flow in solving a problem. In this research, the portrait phase of students is based on the flow of students’ metacognition skills in solving the study of the resolving domination number based on research-based learning. The flow of metacognition skills is poured in the portrait phase of students with the number of 2 students found subject 1 on very good in metacognition skills and subject 2 on the good in metacognition skills.
5. Conclusion
The research that has been done shows that the implementation of RBL has a significant effect on students’ metacognition skills in the experimental class. Students in the experimental class show positive metacognition skills compared to the control class. The research result shows that students’ learning results and metacognition skills increase seen from the post-test. Finally, we can claim that the implementation of RBL has a significant effect on students’ metacognition skills.

The portrait phase of students is a picture that explains the flow of students’ metacognition skills in solving the study of resolving domination number. It can be known the difference of thinking flow from the students in the control class that has relatively low flow and the experimental class that has relatively high flow.

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