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## IMPROVEMENT OF MATHEMATICS LEARNING OUTCOMES OF MEASUREMENT MATERIAL THROUGH THE APPLICATION OF DISCOVERY LEARNING MODELS

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### **Abstract**

*This study aims to improve the learning outcomes of mathematics through the Discovery Learning model. The 32 students of the fifth grade Papandayan State Elementary School became the subjects under study. The result showed that the learning implementation score in the first cycle was 72.2 and in the second cycle is 85.4. There are behavioral changes in students' discipline, cooperation, confidence and enthusiasm in the first cycle with the acquisition of scores was 69.4, and in the second cycle increases to 81.13; meanwhile the average scores of students learning outcomes in the first cycle was 67.54 with the learning completion of 59.37%, and an average value in the second cycle is 80.86 with the learning completion 87.5%. The results of all aspects have increased: the implementation of learning increases to 13.2%, changes in student behavior with 11.73%, and completeness of mathematics learning outcomes increases to 28.13%. It can be concluded that the application of the Discovery Learning model improves the students' students' activities in each cycle.*

**Keywords:** *Learning outcomes, Mathematics, Discovery Learning*

### **Abstrak**

Matematika merupakan mata pelajaran yang sering dikatakan sebagai mata pelajaran yang sulit. Kenyataan ini didukung dengan rendahnya tingkat keberhasilan belajar yang didapat peserta didik. Oleh sebab itu penelitian dilakukan untuk mencari model yang tepat dalam peningkatan hasil belajar. Mengacu pada permasalahan tersebut, penelitian ini bertujuan untuk meningkatkan hasil belajar matematika melalui model Discovery Learning. 32 siswa dari kelas lima Sekolah



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Dasar Negeri Papandayan menjadi mata pelajaran yang diteliti. Penelitian tindakan kelas diberikan pada kelas dengan nilai rendah. Penelitian dilakukan menerapkan model pembelajaran dengan dua siklus. Hal ini bertujuan guna mendapatkan hasil yang sesuai dengan indikator. Hasil penelitian menunjukkan bahwa skor implementasi pembelajaran pada siklus pertama adalah 72,2 dan pada siklus kedua adalah 85,4. Ada perubahan perilaku dalam disiplin siswa, kerja sama, kepercayaan diri dan antusiasme pada siklus pertama dengan perolehan skor adalah 69,4, dan pada siklus kedua meningkat menjadi 81,13; Sementara itu skor rata-rata hasil belajar siswa pada siklus I adalah 67,54 dengan ketuntasan belajar 59,37%, dan nilai rata-rata pada siklus II adalah 80,86 dengan ketuntasan belajar 87,5%. Hasil semua aspek telah meningkat: pelaksanaan pembelajaran meningkat menjadi 13,2%, perubahan perilaku siswa dengan 11,73%, dan kelengkapan hasil belajar matematika meningkat menjadi 28,13%. Dapat disimpulkan bahwa penerapan model Discovery Learning meningkatkan aktivitas siswa siswa dalam setiap siklus.

**Kata kunci:** Hasil belajar, Matematika, Discovery Learning

Every student should achieve the learning outcomes of each subject they study, and one of the subject is mathematics which becomes a subject that benefits students' lives. It could be said that its function is as wide as the language with has close relation to knowledge, and sciences, and it cannot be argued that it has been used in all aspects of human life. Mathematics is a critical basic skill which mostly ignored by the researchers (Kurniasih & Sani, 2014; Chandler, 1978; Brezovszky, et. al., 2019).

A survey done by the Indonesian National Assessment Program (INAP) Kemendikbud shows that four grader of elementary school in Indonesia pose a lower skill in mathematics literacy. It is shown that only 2.29% students belong to good category, 20.58% belong to fair category, and 77.13% students belong to poor category (Novak & Tassel,

2017). Mathematics is considered a difficult subject and makes students afraid of it. The condition is shown supported by the result of Survey of Programme for International Student Assessment (PISA). The survey done to students of 15 years age in 2015 posed that their ability in math is in rank 63 from 72 countries. This achievement is far away compared to the countries in Southeast Asia, such as Vietnam which is in rank 12th, while Singapore is at first rank (Hasratuddin, 2014). The fact is inline with the observation result that mathematics learning is hard to achieve the minimal criteria of 70. The mathematics low learning outcome might be caused by the absence of innovative learning model. Therefore, it is necessary to carry out the research with the aim of improving its outcome by applying discovery learning model.

Mathematics is said to be deductive science that refers to an axiomatic system, the principle of obedience and has abstract object of direct object and indirect objects (Sonmi Jo & Ja-Ok Ku, 2011; Worthen, 1968; Van, 1998; Ames, 2016). It is also defined as a means that can foster a logical, systematic, critical, objective, rational and obedient mindset. In general, the work in mathematics is to show and prove the truth. By abstracting objects in mathematics, it is natural that understanding a concept in mathematics would require more analysis than other sciences, and often students will face difficulties (DeDonno, 2016).

Based on the explanation above, it can be synthesized that fractional material learning outcomes are students' changes as a whole in knowledge, behavior, attitudes, skills and abilities in problems solving, especially problems relate to daily life in mathematics subject such as in fractions from abstract to concrete, from difficult ones becomes easier after the students undergo the learning process. The expected change is an increase in students' understanding of the material taught that they can develop further.

Discovery Learning learning model is a teaching method that is often referred to as discovery method increases retention and transfer of concepts (Stewart, et. al., 2012). Discovery learning learning is a form of learning that is very independent and constructive (Pratiwi, et. al., 2015). Meanwhile according to Riyanti (2017) the notion of discovery learning is interpreted as learning emphasized in student activities. Thus

it can be synthesized that discovery learning learning model is a learning process in which the delivery of material is presented incompletely and requires students to be actively involved in finding a concept or principle that they have not yet known.

### Method

This research is an action research, where the action taken in the learning process in the classroom in this study is the application of the Discovery Learning model. The research design can be seen in the following figure.

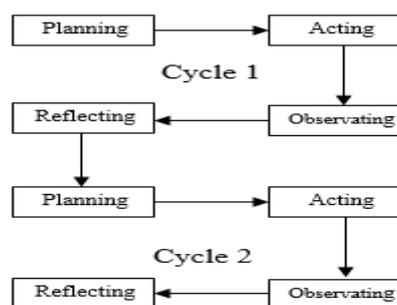


Figure 1. Research Design

The subjects of this study were elementary school students of the fifth grade even semester 2017/2018 academic year, with 32 students consisting of 18 male students and 14 female students. This research instrument is a learning device and data collection instrument. Data collection instruments consisted of observation sheets and test kits for mathematics learning outcomes. Observation sheets are used to get data about teacher and student activities during the learning process. The mathematics learning achievement test kit consists of grids and questions for cycles I and II. Mathematics learning outcomes test is used to collect data about student

mathematics learning outcomes after completing a basic competency with the learning process using the Discovery Learning model. Data collection techniques in this study are observation techniques and learning achievement test techniques. Data from observations were analyzed with descriptive narrative analysis techniques while data obtained from students' mathematics learning achievement tests were analyzed with descriptive statistical analysis techniques. The analysis was conducted to determine the achievement of each indicator by each student. Students are said to reach the KKM indicator if it has scored  $\geq 70$ . In the analysis of the KKM achievement indicator Knowledge, researchers can also see where the location of student errors in solving problems or problems. Data analysis on the achievement of Knowledge indicators was carried out by calculating the percentage of students who reached the KKM on each indicator.

### Results and Discussion

This research was conducted in two cycles with three aspects studied in each cycle, namely the assessment of the implementation of learning, improvement of students' behavior, and learning outcomes of mathematics. The following discusses the implementation aspects of learning and learning outcomes studied in cycles I and II.

- a. Data of Assessment Result in Cycle I Learning Implementation  
 Research data can be seen in the following table 1.

Table 1. Assessment Result of Learning Implementation in Cycle 1

| Collaborator | Final Result | Interpretation |
|--------------|--------------|----------------|
| I            | 72,3         | Fairly good    |
| II           | 74           | Quite good     |
| Total        | 146,3        |                |
| Mean         | 73,15        | Fairly good    |

The table above shows that the learning process in the first cycle obtained a value with an average of 73.15 with a fairly good interpretation. This can be seen from the result of the assessment of collaborator I who gave a score of 72.3 with fairly good qualification and collaborator II gave 74 with a good enough qualification.

- b. Description of changes in student behavior

Data on changes in student behavior in this study can be seen in the table.

Table 2. Result of Student Behavior Improvement in Cycle

| Group   | Collaborator |       | Total  | Average | Interpretation |
|---------|--------------|-------|--------|---------|----------------|
|         | 1            | 2     |        |         |                |
| 1       | 60           | 69    | 138    | 69      | Fair           |
| 2       | 68           | 69    | 137    | 68.5    | Fair           |
| 3       | 70           | 70    | 140    | 70      | Fair           |
| 4       | 69           | 70    | 139    | 69.5    | Fair           |
| 5       | 71.5         | 72.5  | 144    | 72      | Fair           |
| 6       | 68.75        | 67.5  | 136.25 | 68.12   | Fair           |
| 7       | 67.5         | 70    | 137.5  | 68.75   | Fair           |
| Sum     | 483.75       | 488   | 971.75 | 485.88  |                |
| Average | 69.10        | 69.71 | 138.82 | 69.41   | Fair           |

Table 2 shows that group 1 obtained an average value of 69, group 2 obtained an average value of 68.5, group 3 obtained an average score of 70, group 4 obtained an average score 69.5, group 5 obtained an average score of 72, group 6 obtained an average score of 68.12 with sufficient interpretation, and group 7 obtained an average value of 68.75. All average scores belong to fair interpretation. In the second cycle this has increased to average value of 69.41.

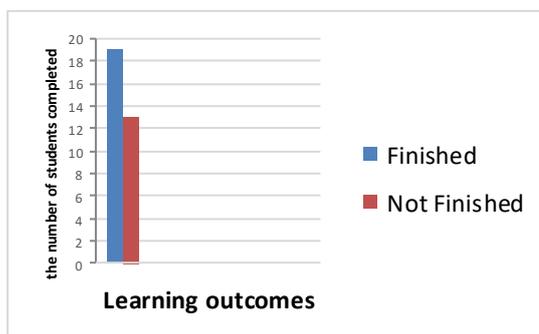
- c. Data Description of Learning Outcomes

The assessment in cycle I (test) is carried out after learning takes place. 32 students of grade five joined the test. From the implementation of the assessment of the first cycle, the learning outcomes obtained can be seen in the table 3 below.

**Table 3. Learning Outcome Completeness of Cycle I**

| No | Learning Result | Frequency | Percentage |
|----|-----------------|-----------|------------|
| 1  | Finished        | 19        | 59.37%     |
| 2  | Not Finished    | 13        | 40.63%     |
|    | Total           | 32        | 100%       |

The table explains that only 59.37% or 19 students achieved mastery learning, while 40% or 13 students have not achieved it yet. Achievement of completeness can be seen in the following figure.



**Figure 2. Learning Outcomes of Cycle I**

Figure 2 above illustrates that in the first cycle, the completeness of mathematics learning outcomes of 19 students have reached the minimal criteria. However, 13 students have not yet reached it yet.

**d. Data of Assessment Result in**

**Cycle II Learning Implementation**

The results of the Cycle II Learning Implementation Assessment can be seen in the following table.

**Table 4. Assessment Results of Learning Implementation in Cycle 2**

| Collaborator | Final Result | Interpretation |
|--------------|--------------|----------------|
| I            | 85.3         | Good           |
| II           | 87.5         | Good           |
| Total        | 172.8        |                |
| Mean         | 86.4         | Good           |

Table 4 above shows that the assessment of learning implementation in Cycle II has increased. Collaborator I gave score 85.3, collaborator II gave 87.5, and both of the scores belong to good interpretation, since it obtain an average value of 86.4 with good interpretation.

**e. Data of Student Behavior Improvement Result in Cycle II**

Data on changes in student behavior in cycle II can be seen in the table 5.

**Table 5. Results of Student Behavior Improvement in Cycle II**

| Observed Aspect                 | Result Cycle |                               |       |         | Description    |
|---------------------------------|--------------|-------------------------------|-------|---------|----------------|
|                                 | I            |                               | II    |         |                |
|                                 | Score        | Meaning                       | Score | Meaning |                |
| Learning process assessment     | 72.2         | Fair                          | 85.4  | Good    | Increase 13.2  |
| Assessment of student behavior  | 69.4         | Poor interpretation           | 81.13 | Good    | Increase 11.73 |
| Mastery learning                | 59.37        | Has not reached that criteria | 87.5  | Good    | Increase 28.13 |
| The average of learning outcome | 67.54        | Fair                          | 80.86 | Good    | Increase 13.32 |

The table above shows that the average value for group 1 is 82.5, group 2 has 81, group 3 gets 83 (good interpretation), group 4 gets 74 (fair interpretation), group 5 obtains 90.62, group 6 has 81.85 (good interpretation), and group 7 has 75 with (fair interpretation). In Cycle II, the average score has increased to 81.13.

f. Data Description of Research Results in Cycle II

The test in Cycle II was carried out after the learning took place, with 32 students of five grade. From the implementation of Cycle II, the learning mastery of the Cycle II was obtained as it can be seen in tabel 6 below.

Table 6. The Learning Mastery in Cycle II

| No    | Learning Mastery | Frequency | Percentage |
|-------|------------------|-----------|------------|
| 1     | Finished         | 28        | 87.5       |
| 2     | Not Finished     | 4         | 12.5       |
| Total |                  | 32        | 100        |

Based on table 6 above, it can be seen that students' learning outcomes in Cycle II has increased compared to the one in Cycle I in which 28 students (87.5% ) has reached it, while students there are four (12.5%) students who have not completed it. The average value obtained is 80.8 as it can be seen in the following figure

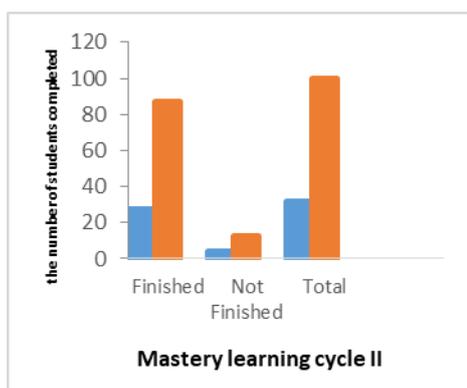


Figure 3. Learning Mastery of Cycle 2

Figure 3 shows the completeness of the mathematics learning outcomes in the second cycle, with 28 students have reached the minimal criteria, and four students have not reached it.

## DISCUSSION

The results of the study are discussed in each cycle, and the clarification is presented in the table as follows.

Tabel 7. Recapitulation Result of Cycle I and II

| Observed aspect                 | Result Cycle |                               |       |         | Description    |
|---------------------------------|--------------|-------------------------------|-------|---------|----------------|
|                                 | I            |                               | II    |         |                |
|                                 | Score        | Meaning                       | Score | Meaning |                |
| Learning process assessment     | 72.2         | Fair                          | 85.4  | Good    | Increase 13.2  |
| assessment of student behavior  | 69.4         | poor interpretation           | 81.13 | Good    | Increase 11.73 |
| Mastery Learning                | 59.37        | Has not reached that criteria | 87.5  | Success | Increase 28.13 |
| The average of learning outcome | 67.54        | Fair                          | 80.86 | Good    | Increase 13.32 |

The table above explains that all aspects studied have increased. In Cycle I the assessment of learning implementation reached a value of 72.2% with a fairly good category, in cycle II it increases to 85.4% in the good category.

Similarly to the assessment of student behavior; In Cycle I, the score was 69.4% (poor interpretation), and after improvement in cycle II, it increases to 81.13% with good interpretation.

Other research aspect that also increases is student learning outcomes. In Cycle I, the completeness of the five grade students learning outcomes classically only reached 59.37%, and it increases to 28.13% in the Cycle II to be 87.5%. It means that the study was completed in Cycle II because the research is successful.

The research with discovery learning model shows an increase, both on learning outcomes and students the behavior in the classroom. This condition is also found in several studies that had been conducted, the findings reveal that the discovery learning improves student learning

activities in the classroom. As in research Iklima, et. al. (2018) discusses the implications of adopting an educational model of discovery learning for distance education, students reviewing strategies for increasing subjects towards learning theory and analyzing the way students engage with subject content and assessment. The subject redesign results include increased student satisfaction, greater retention and higher grades even though there was an increase in overall assessment requirements. This shows that discovery learning based on group work has positive results. Then, the following research Yudha (2017) shows that learning with discovery learning is effective, both cognitive and emotional factors. Similarly, it was also found in research Hasratuddin (2014) learning through discovery learning can grow and improve student outcomes including knowledge and skills, intrinsic motivation, and skill development. Research Ardiyanti, et. al. (2019) shows the results, they are: (1) making learning design begins with the learning needs of students who do not understand the material prerequisites for real number operations, then develops learning objectives that measure the ability to solve problems, matrix operation material and discovery strategies, (2) the learning process with discovery learning models increases the activity of learners in learning, (3) assessment instruments using written test questions with validity of 0.88, reliability 0.99, level of difficulty in the matter of being and the power of different questions is well received. Likewise research Purnawati, et. al. (2018) shows that discovery learning

model assisted by the media is able to improve student mathematics learning outcomes. Indicated by the initial condition showed that the score was 62,25 with the total number of students who passed were only 10 students and the number of students who hasn't passed were 10 students. At the first cycle of mathematics learning the outcomes increased to become 75,50. It means the percentage of completeness reached 75%. At the second cycle the average of student's learning outcomes increased again to become 83,00. Showed that percentage of completeness reached 90%, Increased learning outcomes were also found in the study Tirto (2018) mathematics learning achievement of students, namely in the Cycle I the average 68 learning outcomes with a percentage of 65% to 80 with a percentage of 85% in the Cycle II, and increased activity of students from the less active category with a percentage of 11.30% in the Cycle I becomes very active with a percentage of 12.40% in Cycle II, and the ability of the teacher to manage learning from the less category in the Cycle I becomes very good in Cycle II. Not much different from the results of the study Nathan S. (1968) that the application of the DL model can improve mathematics learning outcomes in the material of multiplication and fraction distribution. This was also found in the study Bell (1978) the results of the study were obtained; in the pre-cycle 21 students only 6 students (28.57%) were completed and 15 students (71.43%) did not complete with an average score of 51.71. Furthermore, in the Cycle I, after taking action by applying the discovery learning model, a number of 9 students (42.85%) were

declared completed and 12 students (57.15%) were not equipped with a class average of 63.80. The second cycle results that 19 (90.5%) students completed and 2 (9.5%) students did not complete it with a class average of 85.95. This shows that discovery learning model assisted by the media is able to improve students' mathematics learning outcomes. Furthermore, the research Latief (2018) underlines that discovery model assisted by talking stick can be used to improve the learning outcomes of 2nd grade students in Mathematics learning. Likewise research conducted Kusuma (2017) shows that discovery learning models can improve learning outcomes. The results showed that at pre-cycle stage, the data of measurement ability level in the early mathematics was 45.90%. Then it increased to 65.83% at the end of cycle I and increased to 89.10% at the end of cycle II.

Some of these studies have similar results and show that with discovery learning outcomes can increase, also the activities and students behavior experience good changes. Thus the discovery learning model can be applied to learning in both the low and high classes and to the level of education after primary education.

### **CONCLUSSION AND SUGGESTION**

The results of the study can be concluded that the action of research by applying the discovery learning model can improve the learning process of improving mathematics learning outcomes in fifth grade elementary schools. Improvements and improvements can be seen from the results of cycle one and cycle two. In

cycle I, the score was 69.4% (poor interpretation), and after an increase in cycle II, the score increased to 81.13% with good interpretation. Another research aspect that also increased was student learning outcomes. In the first cycle, the completeness of the fifth grade student learning outcomes classically only reached 59.37%, and increased to 28.13% in the second cycle to 87.5%. This means that this research was completed in Cycle II because this research was successful.

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