



## Implementation of Discovery Learning Model in Social Arithmetic Learning for Middle School Students

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**Abstract:** This study aims to analyze the effect of the discovery learning model on student learning outcomes in social arithmetic material. This research is a quasi-experiment with a nonequivalent posttest-only control group design. The population of this study was seventh-grade students of SMP Negeri 6 Bengkulu City. The sample was selected using the purposive sampling technique, namely class VIID as the experimental class with 20 students and class VIIC as the control class with as many as 23 people. Data was collected by using a social arithmetic material test. The data were analyzed descriptively and statistically by using an independent t-test. The results showed an effect of the discovery learning model on improving student learning outcomes in social arithmetic material. Statistically descriptive, the average student learning outcomes using the discovery learning model are higher than in conventional learning classes.

**Keywords:** discovery learning, quasi experiment, learning outcomes.

**Abstrak:** Penelitian ini bertujuan untuk menganalisis pengaruh model discovery learning terhadap hasil belajar siswa materi aritmetika sosial. Penelitian ini merupakan eksperimen semu dengan desain nonequivalent posttest-only control group. Populasi penelitian ini adalah siswa kelas VII SMP Negeri 6 Kota Bengkulu. Sampel yang dipilih dengan menggunakan teknik purposif sampling yaitu siswa kelas VIID sebagai kelas eksperimen dengan jumlah siswa sebanyak 20 orang dan kelas VIIC sebagai kelas kontrol sebanyak 23 orang. Pengumpulan data dilakukan dengan tes materi aritmatika sosial. Data dianalisis secara deskriptif dan statistik inferensial menggunakan uji t independent. Hasil penelitian menunjukkan bahwa terdapat pengaruh model discovery learning terhadap peningkatan hasil belajar siswa materi aritmatika sosial. Secara statistik deskriptif rata-rata hasil belajar siswa menggunakan model discovery learning lebih tinggi dibandingkan kelas pembelajaran konvensional.

**Kata kunci:** discovery learning, eksperimen semu, hasil belajar.

### ▪ INTRODUCTION

Facts that occur in learning mathematics in schools today, one of which is still found in teacher-centered learning. At the same time, the implementation of the 2013 curriculum requires students to learn actively. So learning mathematics does not focus on developing a student's ability to find. In addition, the teacher's ability to package material in the classroom impacts the ultimate goal of learning. The lack of mastery of learning methods and approaches by teachers is one of the factors that cause problems in learning mathematics (Sari, 2019). Applying a suitable learning model with the characteristics of the material is essential in achieving the learning objectives. According to Isrok'atun and Rosmala (2018), the learning model is a learning component that becomes a guide in carrying out the activity steps from the beginning to the end of learning.

A common problem in learning mathematics in schools, especially junior high schools, is the achievement of student learning outcomes that have not been maximized. The results of the author's observations at SMP Negeri 6 Bengkulu City found that students' activeness in learning mathematics was still low. Students are still passive and only accept the material presented by the teacher during the learning process. In addition, the achievement of student learning outcomes is still low. The results of the Mid-Semester Assessment for grade VII students in the 2021/2022 academic year showed that around 90% of grade VII students scored below the minimum competence ability set by the school, which was 70. The results of interviews with several students concluded that the student's response to learning mathematics was that most of the participants still consider mathematics complicated, causing students to be less enthusiastic about learning mathematics. In addition, the absence of an active role for students in finding mathematical concepts directly makes students' understanding of mathematics learning less likely to last long.

In increasing the achievement of student learning outcomes, it is necessary to present material that is interesting and easily understood by students. The selection of a suitable learning model can increase the active participation of students; this, of course, will impact student learning outcomes. Based on theoretical and empirical studies, one of the learning models that can grow students' thinking skills is discovery learning. The application of modeled discovery learning has advantages in helping students to improve and enhance cognitive skills and processes (Rosdiana, Boleng & Susilo, 2017). According to Mukhammad et al. (2021), the best learning is when students find the information and concepts they learn for themselves. The discovery learning model involves the active role of students in finding concepts so that the quality of learning will also increase. In the discovery learning model, students must actively think, examine ideas, collect information, solve problems and apply what has been learned. Discovery Learning is a learning model that provides opportunities for students to find information on their own, investigate themselves, and organize material independently (Surur & Oktavia, 2019; Rahmat et al., 2021; Zetriuslita & Alzaber, 2020).

Several empirical studies show that discovery learning impacts mathematics learning outcomes. Research conducted by Fitriyah, Murtadlo, & Warti (2017); (Surur & Oktavia (2019); Sutrisno, Happy, & Susanti (2020). The application of discovery learning can support students' thinking skills through discovery. This is also influenced by students' memory of the concepts found. One of the materials that can be applied to the discovery model is social arithmetic material. So the researchers observed whether the discovery model impacted student learning outcomes on social arithmetic material.

## ▪ **METHOD**

### **Participants**

The population in this study were all seventh-grade students of SMP Negeri 6 Bengkulu City for the 2022 academic year. The population was spread over 4 classes with a total of 106 students. In selecting the research sample from the existing population, a purposive sampling technique was used where the sample selection was based on the average ability of the two classes. Sample was class VIID and VII C. The two classes were drawn by lottery, where class VIID was chosen as the experimental class with 28 students and class VIIC as the control class with 27 students.

### Research Design and Procedures

The type of research that researchers use in this study is quasi-experimental research. The design used in this study is the nonequivalent posttest-only control group design. In the research, the experimental class was given treatment as a discovery learning model, and the control class used expository learning. The research implementation procedure refers to the experimental research stages starting from sample selection, instrument testing, treatment implementation, data collection, data analysis, and conclusion.

### Instruments

The research instrument used in this study consisted of lesson plans and a post-test instrument. Posttest used essay questions with social arithmetic material. The test instrument is seen for feasibility through logical validity tests and Hoyt reliability tests. The logical validity of an instrument is the validity that is carried out based on the considerations of experts (Lestari & Yudhanegara, 2018). The results of logical validity were analyzed using Aiken's V. The following criteria interpret the degree of logical validity of the instrument based on the Aiken index.

**Table 1** Logical validity criteria

Value Index validity	Interpretation Validity
$< V \leq 1.00$	Very Valid
$< V \leq 0.80$	Valid
$\leq V \leq 0.40$	Invalid

(Irawan & Wilujeng, 2020)

The results of the logical validity analysis using the Aiken index in the research instrument are summarized in the following table:

**Table 2** Logical validity test results

Question	V-Value	Description
1	0.87	Very Valid
2	0.86	Very Valid
3	0.90	Very Valid
4	0.92	Very Valid
5	0.91	Very Valid

In Table 2, it can be seen that the results of the logical validity test by the three validators on the posttest test instrument with 5 questions declared very valid; namely, the 1st to 5th questions are in the range of  $0.86 < V < 0.92$ , it can be concluded that the five questions are feasible and can be used. Furthermore, the results of the expert assessment of the test instrument were carried out by the Hoyt test, which aims to see the significance of the assessment between validators. The criteria used are instruments considered reliable if the results of the Hoyts  $r_{11} > 0.40$ . Based on the results of the Hoyt test, an R-value of 0.61 ( $r_{11} > 0.40$ ) is obtained, which means that the assessment given is meaningful. The reliability test of the questions was carried out to see the consistency or consistency of the research test instrument questions. The following is the Cronbach alpha formula to measure the reliability of test instrument learning

outcomes.

To ensure the validity of the research data sources, the instrument is tested empirically, namely the reliability test. The results of the reliability test analysis using Cronbach's alpha obtained a calculated  $r$  value of 0.70 with very reliable criteria. The aspects of validity and reliability that have been carried out are the stages of testing the data collection instrument in this study.

### Data Analysis

The data analysis technique in this study consisted of descriptive and inferential statistical analysis. The descriptive analysis describes the data on student learning outcomes, namely the data's mean, maximum, minimum, and standard deviation. The inferential analysis tests the hypothesis, namely the independent sample t-test. The analysis begins with prerequisite analysis, namely the normality and data homogeneity tests. The statistical hypotheses tested are:

$H_0: \mu_1 = \mu_0$  (The average learning outcomes in both groups are the same.)

$H_1: \mu_1 \neq \mu_0$  (The average learning outcomes in the two groups are not the same)

The test criteria used are the null hypothesis ( $H_0$ ) is rejected if the value of  $t_{count}$  is more than  $t_{table}$  ( $t_{count} > t_{table}$ ) or  $t_{count}$  is less than  $-t_{table}$  ( $t_{count} < -t_{table}$ ).

### ▪ RESULT AND DISSCUSSION

This research was conducted at SMPN 6 Bengkulu city from March to April 2022. Before completing the research, all research instruments were validated first. After all the instruments were declared to be able to be used in the study, all students were given a post-test test instrument as a tool to see student learning outcomes. The test questions consist of 5 essay questions with social arithmetics material. The description of the research data shows that the average learning outcome in the experimental class is higher than the control class, which is 64.85 in the experimental class and 49.44 in the control class. The maximum value for the experimental class is 97.00, and the control class is 89.00, with each standard deviation of 15.97 and 21.08.

The posttest data of students in each class after treatment was analyzed for hypothesis testing. First, the data were tested for prerequisite analysis, namely normality and homogeneity. The results of the analysis of the normality test using the Shapiro-Wilk test obtained a  $T_3$  count in the experimental class of 0.963 with a  $T_3$  table of 0.924. While in the control class, the calculated  $T_3$  value obtained was 0.955 with a  $T_3$  table of 0.923. This means that the posttest data in both classes meet the normality criteria. Another aspect met in this study's data analysis is the data's homogeneity test. The calculation using fisher's exact test shows that the data from the two sample classes are homogeneous. The value obtained is  $F_{ount} = 1.74$ , and the importance of  $F_{table} = 1.94$  so that  $F_h = 1.74 < 1.94 = F_t$  then, it can be concluded that the two sample class data are homogeneous. From the prerequisite test, the analysis shows that the data is usually distributed and homogeneous so that hypothesis testing can be carried out.

After the two aspects are met, the data are normally distributed and homogeneous, and the hypothesis testing analysis is carried out with the independent sample t-test. That the results of the test count  $t_c = 2.99$  and  $t_t = 1.94$  so that  $t_{count} > t_{table}$ , which is  $2.99 > 2.007$ , then  $H_0$  is rejected and  $H_1$  is accepted. So it can be concluded that there is a significant influence on the application of the Discovery learning model to student

learning outcomes in social arithmetic learning material for class VII at SMPN 6 Bengkulu City.

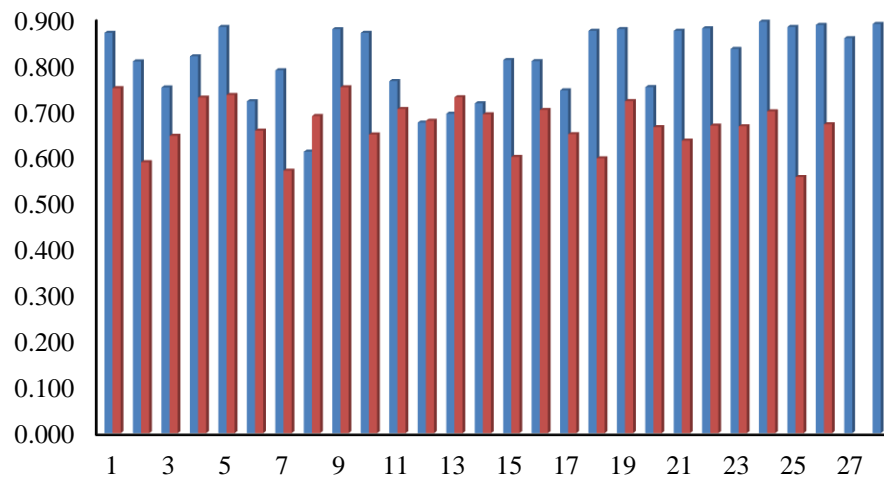
After the two aspects are met, the data are normally distributed and homogeneous, and the hypothesis testing analysis is carried out with the independent sample t-test. Learning in the experimental class and control class was carried out in five meetings. Based on the learning process of the experimental class and the control class, there are differences in the learning process between the two classes. The first difference can be seen in the stages of learning carried out. In the experimental class that uses the discovery learning model, there are 6 stages of learning the form of stimulation or giving the stimulation, problem statement, data collecting, data processing, verification, and concluding. In comparison, the control class that uses expository learning has 6 stages of learning the form of preparation, presentation, correlation, concluding, and application.

There are also differences in students' enthusiasm to participate in learning in the learning process. In the experimental class using the discovery learning model, students are more enthusiastic about learning because of the use of learning media in student worksheets. While in the control class, students tend to have less enthusiasm because the learning is carried out the same as usual, without using student worksheets and learning media. In addition, learning discovery learning using student worksheets media also makes students more active in asking questions, discussing, and doing other learning activities such as finding formulas, calculating, and concluding. In expository learning, students tend to be passive during the learning process because the information on learning materials is given directly by the researcher. Students only carry out activities to find their information from learning materials. Students only carry out active activities to calculate and make conclusions together when they receive instructions or orders from the teacher in the phase of applying and concluding.

The use of the discovery learning model also has advantages over expository learning. The learning stages of discovery learning encourage students to be active in learning activities by finding their concepts so that the information obtained by students lasts longer or makes an impression. The use of student worksheets media also trains students in answering questions in a coherent and orderly manner because, in student worksheets, there are steps that are presented incompletely. Meanwhile, in the expository class, the teacher limited the information obtained by students. Students only get information about learning materials in the form of understanding, formulas, and examples of questions from the teacher's explanation in front of the class. This causes information about learning materials to be quickly forgotten by students because there is no direct involvement in finding the concept of the material.

The use of the discovery learning model also has advantages over expository learning. The learning stages of discovery learning encourage students to be active in learning activities by finding the concept so that the information obtained by students lasts longer or makes an impression. The use of students' worksheets media also trains students in answering questions in a coherent and orderly manner because, in the student worksheets, there are steps that are presented incompletely. While in the expository class, the information obtained by students is limited by the teacher. Students only get information about learning materials in the form of understanding, formulas, and sample questions from the teacher's explanation in front of the class. This causes

information about learning materials to be easily forgotten by students because there is no direct involvement in finding the concept of the material. The results of the analysis of the increase in the value of each treatment class before and after being given action using n-gain analysis as shown below



**Figure 1.** N-gain value of experimental (blue) and control (red) class students

The graph in Figure 1 shows a difference in the increase between the pretest and posttest in each treatment class. Based on the results of the gain analysis, it can be seen that the experimental class given the discovery model has a higher gain, meaning that in terms of learning effectiveness, on average, the discovery class is more effective than the conventional class. Several previous studies support the results of this study; research conducted by Tran et al. al (2014) shows that the discovery learning model can help students in learning mathematics.

The difference in student learning outcomes can be seen clearly from the results of the post-test answers of the two classes. The results of the answers to the final test (posttest) conducted by the researcher in the two classes found that in the experimental class using the discovery learning model, and the answers were written more completely than in the control class using expository learning.

<p>dik: meminjam uang sebesar: Rp. 300.000 bunga tunggal sebesar: 12% ✓(2)</p> <p>dit: jika arya meminjam uang selama 8 bulan! ✓(2)</p> <p>Jwb: modal awal &amp; persentase bunga tunggal</p> <p>= Rp. 300.000 × 12% → bulan</p> <p>= Rp. 300.000 × <math>\frac{12}{100} \times \frac{8}{12}</math></p> <p>= Rp. 3.000 × 8</p> <p>= Rp. 24.000 ✓(4)</p> <p>= Harga awal + Harga Bunga tunggal</p> <p>= 300.000 + 24.000 ✓(4)</p> <p>= 324.000 ✓</p> <p>Jadi, keseluruhan nominal uang dibayarkan arya adalah 324.000. ✓(2)</p>	<p>Dik</p> <p>Pinjam uang arya : Rp 300.000</p> <p>bunga tunggal = 12% tahun ✓2</p> <p>Dit: berapa uang arya ? ✓2</p> <p>Jwb : besar bunga 12% × <math>\frac{\text{bulan}}{12}</math> uang arya</p> <p>= <math>\frac{12}{100} \times \frac{8}{12} \times 300.000</math></p> <p>= 1 × 8 × 300 ✓</p> <p>= 24.000 ✓</p> <p>= 24.000 + 300.000</p> <p>= 324.000 ✓ ✓</p> <p>Jadi, .... ? Tidak ada kesimpulan</p>
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Figure 2. Comparison of student answers

In Figure 2, it can be seen that the answers to posttest question number 4 of the experimental class students, with complete explanations and working on the solutions, were written neatly and correctly. They were writing answers more coherently or regularly. The student explained a full explanation starting from the beginning of the single interest rate, the capital that must be created at the end of the settlement. Figure 2 above shows that the answers to post-test question number 4 of the control class students were written more or less complete, and the answers were written less regularly. In the control class, students write down the answers correctly, but the stages of the process are not written completely and clearly, and there is no conclusion at the end of the completion. Students only write calculations without a prior explanation of what is being searched/calculated; this causes difficulties in distinguishing the work stages carried out by students.

Based on the explanation of the analysis carried out by previous researchers, the results obtained by researchers in this study are the results of hypothesis testing, which state that  $t_{\text{count}} > t_{\text{table}}$ , which is  $2.99 > 2.007$ , so based on the hypothesis testing criteria, namely  $H_0$  is rejected if the value of  $t_{\text{count}}$  is less than  $t_{\text{table}}$  ( $t_{\text{count}} > t_{\text{table}}$ ), then  $H_0$  is rejected, and  $H_1$  is accepted, it can be concluded that there is a significant influence on the application of the discovery learning model to student learning outcomes in social arithmetic learning material for class VII at SMPN 6 Bengkulu City.

From these results, it can be concluded that this research is in line with previous research. In previous studies, similar results were obtained, and there was an influence on the application of the discovery learning model. In a study conducted by Fitriyah, it was stated that students' mathematics learning outcomes using the discovery learning model were different or better than student learning outcomes that used conventional learning (Fitriyah, Murtadlo, & Wartu, 2017). The difference in learning outcomes between discovery learning classes and direct learning classes is because the discovery learning class involves many students in teaching and learning activities (Surur & Oktavia, 2019). In the discovery learning process, students actively find information and concepts from the learning. The involvement of students in finding information and

concepts independently makes the information obtained by students tend to last longer than in the expository class, which relies on information provided by the teacher so that information is easy to forget. Research conducted by Sutrisno revealed that the classroom learning process that applies the discovery learning model is more active in learning activities, which is different from conventional classes where students are passive (Sutrisno, Happy, & Susanti, 2020).

The difference in learning outcomes between the experimental class and the control class was caused by several factors. The factors that cause differences in learning outcomes between the two classes consist of the following factors. Factors in the learning process, the use of different learning models certainly results in a different learning process. In the experimental class with the discovery learning model, 6 stages of learning encourage students to be active in the learning process. While the control class with expository learning has 6 steps that do not promote active students in learning, or the learning that occurs tends to be passive. Differences in the learning process certainly produce different learning experiences and learning outcomes.

The learning media factors and the learning media used by the two classes are also different. The experimental class used learning media as student worksheets, while the control class did not use student worksheets as learning media. Learning media has an important role in supporting the success of the learning process. The selection of suitable learning media can increase the effectiveness and efficiency of the learning process so that learning objectives can be achieved properly (Mashuri, 2019).

Individual factors of students in the learning process, there are differences in students' enthusiasm. In the experimental class that uses the discovery learning model and students' worksheet media, students have more confidence and enthusiasm in learning compared to the control class with expository learning. Students are less enthusiastic about learning because the learning obtained is the same as what they usually do. Learning media helps stimulate students' enthusiasm for learning (Sari, 2019). The material used in this study is social arithmetic, which discusses sales, purchases, profits, losses, net, tare, gross, discounts, taxes, and interest, often done or experienced in everyday life. The material familiar with daily life is a distinct advantage for students because students can imagine it directly. However, in this study, the delivery of the material provided was still difficult for students to accept, especially in the control class, where students tended to be passive and rarely asked questions.

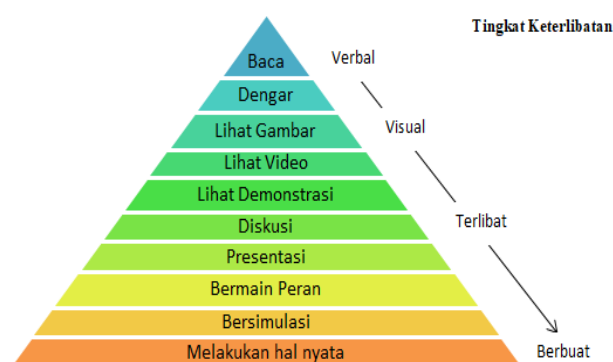
Factors in the learning environment of less conducive students are one of the obstacles to research. The classroom atmosphere tends to be noisy and not conducive, which causes the learning to be carried out less efficiently because the researchers spend much time neutralizing the classroom atmosphere again. The learning time factor, this research was carried out during the transition from pandemic learning (online) and post-pandemic learning (offline), thus causing the enthusiasm for learning and capturing learning information from students also to decrease. As well as the adjustment of study time made after the pandemic, which often changes, causes research to be less effective.

From some of the factors mentioned, it can be concluded that to obtain successful learning, an understanding of learning models, learning media, and the characteristics or environmental conditions of students is needed to achieve appropriate and effective learning. Using learning models and media is the most significant factor in learning success. The use of proper and appropriate learning models can produce maximum



learning. On the contrary, the provision of learning models and media that are not suitable can cause the learning carried out to be less meaningful.

The existence of different factors in the learning process from the stages of learning carried out resulted in different experiences and learning outcomes. In learning with the discovery learning model, students carry out activities like discussing, processing data, concluding, and presenting. Meanwhile, in expository learning, students only listen and see demonstrations of the material made by the teacher in front of the class. According to the cone of the learning experience by Edgar Dale, the success of learning can be seen from the learning process carried out. The cone of experience from Edgar Dale illustrates that the more concrete students gain learning experiences, the more experiences experienced students have. Conversely, the more abstract the students' learning experiences, the fewer experiences students gain (Noviyanti & Moerti, 2019).



**Figure 2.** The cone of Edgar dale's learning experience

Source : (Noviyanti & Moerti, 2019)

In figure 3 above, it can be seen the learning experience that occurred between the two classes. In the expository class, the learning experience gained is visual or visual. The expository class learning experience is only limited to listening and seeing the demonstration of the material provided; this is what causes students to have an abstract learning experience due to the absence of direct involvement from students in the learning process. While in the learning model of discovery learning, the learning experience obtained by students is at a more concrete level. Students are already involved in the learning process. The understanding of being involved in discussions, presenting work, or presenting results in the form of presentations is the involvement of students in learning (Agustian, 2019). In the discovery learning process, students conduct discussions and presentations, so it can be said that students are involved in the learning process. This results in more student learning experiences and makes more impression on students' memories.

The use of student worksheets media also trains students in answering questions in a coherent and orderly manner because, in student worksheets, there are steps that are presented incompletely. While in the expository class, the information obtained by students is limited by the researcher/teacher. This causes information about learning materials to be easily forgotten. So it can be concluded that many factors influence learning outcomes between the two classes, namely the differences in the learning

process, the media and materials used, factors that arise from the characteristics of students, the environment, and the research time.

## ▪ CONCLUSION

The findings of this study are the effect of the application of the discovery learning model on student learning outcomes. Student learning outcomes given discovery learning are better than conventional learning. The increase is through the emphasis on the discovery stage in learning which is implemented in the student activity sheet. The results of the gain test analysis also show that the discovery model is more effective than conventional learning. The impact of the results of this study on learning in secondary schools where teachers can design learning with a discovery learning model. Students who are invited to find concepts in a guided manner will remember the concepts better in solving problems. This study has limitations, one of which is that the sample used is only two classes and comes from the same school, so the sample diversity has not been met.

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