

Implementation of Discovery Learning Model with Student-Friendly Teaching Aids to Grow Mathematical Reasoning Ability SLB Students

Sugiman¹, A.A. Rohmah², E. Pujiastuti³, SLW.Handayani⁴

¹(Mathematics Department, Universitas Negeri Semarang, Indonesia)

²(Mathematics Teacher, MTs Al-Mu'awanah Petarukan, Indonesia)

³(Mathematics Department, Universitas Negeri Semarang, Indonesia)

⁴(Teacher, SLBN Salatiga, Indonesia)

Abstract:

Background: The importance of mathematical reasoning abilities for students is not in accordance with the facts in the field, where the level of students' mathematical reasoning ability is still low. Based on Trends in International Mathematics and Science Study (TIMSS) 2015 shows only 4% of students are able to answer math problems with reasoning domains.

Materials and Methods: This research is a research method of mix method to know the characteristic, cause of the difficulty of mathematical reasoning and to know whether the discovery learning model assisted by the student friendly aidl can grow the students' mathematical reasoning ability with the sample of grade VII students with hearing impairment SMPLB Negeri Salatiga.

Results: The results showed that the cause of the difficulty of the students with hearing impairment reasoning is the lack of vocabulary mastery and through the application of discovery learning model assisted by student friendly aids make grow students' mathematical reasoning abilities.

Conclusion: The aplication of discovery learning model assisted by students friendly teaching aids make grow students' mathematical reasoning abilities.

Key Word: Discovery Learning, Students Friendly Aids, Reasoning Abilities, Hearing Impairment.

Date of Submission: 13-04-2020

Date of Acceptance: 25-05-2020

I. Introduction

Children with disabilities are children who need some special things in their lives, including in terms of education (Uzunboylu & Özcan, 2019). Disabilities experienced by children with disabilities must be a factor in determining the consideration of innovation that will be done, one of the disabilities that require innovation in the learning process is deaf. Students with hearing impairment certainly need something special and innovative in their learning process so that the material delivered can be received better in accordance with the limitations they have as mentioned by Hastuti & Muhari (2017).

One of the goals of learning mathematics is to develop students' reasoning abilities. National Council of Teachers of Mathematics (NCTM, 2000: 7) mentions that the purpose of learning mathematics is that students must have five mathematical standards of ability that is problem solving, communication skills, connection ability, reasoning ability and the ability of representation. In learning mathematics, reasoning ability is very important in conceptual understanding and problem solving (Liu & Xin, 2017). According to Dewi & Kusumah (2017) there are many problems in mathematics or daily life that require reasoning to solve them. Therefore, it is important to equip students with good mathematical reasoning skills so that students can use them to solve various problems including daily life problems encountered.

It can be concluded that mathematical reasoning ability is very important both in improving mathematics learning achievement and for daily life. However, based on Trends in International Mathematics and Science Study (TIMSS) 2015 shows only 4% of students are able to answer math problems with reasoning domains. It can be illustrated that the students' mathematical reasoning ability in Indonesia is still low and there is a need for learning that can foster the ability of mathematical reasoning. Based on the results of interviews and observations obtained results that the mathematical reasoning ability of grade VII students deaf in SMP Negeri Salatiga still low.

Learning models become things can influence students in understanding the material, including make grow mathematical reasoning abilities from the material provided by the teacher. According to Arivina et al. (2017) the use of inappropriate learning models is one of the factors that affect mathematical reasoning abilities.

Therefore, researchers are interested in using one of the learning models, the discovery learning model with assisted students friendly teaching aids to make grow mathematical reasoning abilities of students with hearing impairment in SMPLB Negeri Salatiga.

According to In'am & Hajar (2016) discovery learning model is a learning model that is designed so that students are active in finding and reflecting during the learning process. Wicaksana & Usodo (2016: 260) said that discovery learning model is a model to develop active student learning by finding your own, self-investigating, the results will be faithful and long lasting in memory, will not be easily forgotten students. Based on the description, the discovery learning model in which knowledge obtained from the findings itself can make grow students' mathematical reasoning abilities. Based on these descriptions, the discovery learning model in which knowledge obtained from the findings themselves can make grow students' mathematical reasoning abilities. The Discovery learning model can improve student learning achievement (Ramdhani et al., 2017). The steps of discovery learning model according to Hosnan (2014: 289) that is (1) *Stimulation*, (2) *Problem statement*, (3) *Data collection*, (4) *Data processing*, (5) *Verification*, (6) *Generalization*.

According to Mariya *et al.* (2013) the effectiveness of a learning is not only determined by the learning model used, but the proper use of media will be able to maximize learning outcomes and one of the media is the props used in learning mathematics. In addition to the benefits of props, another thing to note is the form of props. Therefore in this research the researcher use student friendly tool with indicator (1) introducing, improving, improving understanding of concepts and facts, (2) simplify the abstraction, (3) according to the age of the students, (4) has a form that does not endanger the child (5) has attractive colors by using lead-free dyes and toxic materials, (6) if it is made of metal it must be ensured it does not rust and no paint is peeling off.

The ability of mathematical reasoning in this research based on the classification of mathematical reasoning by Johan Lithner (2008) is imitative reasoning and creative reasoning (CR). Imitative reasoning consisting of memorised reasoning (MR) dan algorithmic reasoning (AR).

Indicator of memorised reasoning (MR):

- Completeness of answers through memory.
- Similarity of writing / drawing without any significant errors.
- Indicator of algorithmic reasoning (AR):
- The selection of problem solving strategies is derived from recalling a rule of thumb (without the need to create new solutions) or minor modifications.
- The settlement strategy is well implemented without any calculation errors or symbol formatting.
- Indicator of creative reasoning (CR):
- Novelty.
- Flexibility.
- Plausibility.
- Mathematical Foundation.

This research aims to determine the characteristics, causes of mathematical reasoning difficulty and find out whether the discovery learning model assisted by students friendly aids can make grow students' mathematical reasoning abilities.

II. Material And Methods

This research is a mixed method research that uses sequential exploratory design that is a research design that begins with collecting and analyzing data qualitatively then proceed with collecting and analyzing data quantitatively.

Study Design: Learning activities by applying Discovery Learning models assisted by student-friendly teaching aids.

Study Location: This research held at 7th grade students with hearing impairment SMPLB Negeri Salatiga.

Study Duration: November 2017-February 2018.

Sample size: 4 students.

Sample size calculation: Sampling in this study using purposive sampling method.

Subjects & selection method: This research was held by the population is students with hearing impairment of SMPLB Negeri Salatiga. Used sampling purposive method sample obtained are 7th grade students with hearing impairment of SMPLB Negeri Salatiga.

Inclusion criteria: 7th grade students with hearing impairment of SMPLB Negeri Salatiga

Procedure methodology

The method used in this research is the method of observation, documentation, test and interview. This research starting in November 2017 by observation and interview to find out the condition of schools, learning in schools and students' mathematical reasoning abilities . After that in November 2017-January 2018, the materials to be given are first determined, compile a learning implementation plan for the application of

discovery learning models assisted by student-friendly teaching aids, compile research instruments in the form of written test questions and interview guidelines before conducting the learning process. After that, researchers do the discovery learning model assisted by student friendly teaching aid with the selected material is kelipatanpersekutuanterkecil (KPK). To know the development of the ability of mathematical reasoning, the researcher conducted the quiz test and then continued the interview. After the material is finished, the final test of mathematical reasoning is done with the interview. The result of initial and final test of mathematical reasoning is then analyzed quantitatively.

Statistical analysis

Quantitative data analysis begins with a normality test and then proceeds with a t-test t-test that aims to determine whether the final test of mathematical reasoning ability is better than the initial test of mathematical reasoning. The normality test criterion is accept H_0 if $L_0 \leq L_{tabel}$ with the value of $\alpha = 0.05$. followed by t-test with criterion of reject test H_0 if $t' \geq \frac{w_1 t_1 + w_2 t_2}{w_1 + w_2}$.

III. Result

After conducting research with the application of the discovery learning model assisted by student friendly aids to 7th grade students with hearing impairment SMPLB Negeri Salatiga, the following results were obtained.

Qualitative Data Analysis

By comparing the results of the initial test of mathematical reasoning with the results of interviews on the subject of B-01 and B-02 indicates that the indicator on Memorized Reasoning (MR) has been met while the Algorithmic Reasoning (AR) and Creative Reasoning (CR) indicators have not been met. The conclusion that can be taken based on this is on the subject of B-01 and B-02 the dominant reasoning type is the Memorized Reasoning (MR) type. As for the subject B-03 indicator Memorized Reasoning (MR), Algorithmic Reasoning (AR) and Creative Reasoning (CR) has not been fulfilled. So that on the subject of B-03 there is no type of reasoning that appears. In the subject B-04 indicator Memorized Reasoning (MR) has been met while Algorithmic Reasoning (AR) has not been met and there are indicators of Creative Reasoning (CR) that has not been met. Thus, the subject of B-04 has the ability of mathematical reasoning type Memorized Reasoning (MR) while the Creative Reasoning (CR) type has not been maximized.

In the test results of the quizzes that have been confirmed through interviews, the results of the B-01, B-02 and B-04 subjects have reasoned reasoning (MR), algorithmic reasoning (AR) and creative reasoning (CR) reasoning skills because all of the indicators have been met. While the mathematical reasoning ability of subject B-02 is the type of memorised reasoning (MR) and algorithmic reasoning (AR) because the creative reasoning (CR) indicator has not been fulfilled.

The final test result of mathematical reasoning ability of subject B-01 is memorised reasoning (MR) and algorithmic reasoning (AR) type. Subject B-02 has met all the indicators of memorised reasoning (MR) and algorithmic reasoning (AR) but there are unanticipated creative reasoning (CR) indicators. The mathematical reasoning abilities possessed by the subject of B-03 after the final test is a memorised reasoning (MR) type. Subject B-04 has memorised reasoning (MR), algorithmic reasoning (AR) and creative reasoning (CR).

Quantitativ Data Analysis

1. Normality Test

The normality test uses the final test scores of mathematical reasoning abilities. Normality test using Lilliefors test. The normality test uses the final test scores of mathematical reasoning abilities. Normality test using Lilliefors test. Based on the normality test that has been done, obtained the result that $L_0 = 0.3451 \leq L_{table} = 0.381$, then H_0 accepted, which means the data comes from a normal distributed population.

2. Hypothesis Test

Hypothesis test is done by comparing preliminary test data value and final test of mathematical reasoning ability using t-test. The t-test results show that $t' = 2.95 \geq \frac{w_1 t_1 + w_2 t_2}{w_1 + w_2} = 2.35$ then H_0 rejected, which means the final test result data of mathematical reasoning ability is more than the result of initial test of mathematical reasoning ability.

IV. Discussion

1. Characteristic of Student Mathematics Reasoning

Based on the analysis of test results and interviews, subjects B-01 and B-02 have the ability of mathematical reasoning type Memorized Reasoning (MR). Thus the subjects B-01 and B-02 are students who can memorize well-given material but have not been able to apply the problem solving strategy. Subjects B-01 and B-02 also have not been able to find a new problem solving strategy other than what is given by the teacher.

In the subject of B-03 there is no type of reasoning that appears. Thus the subject of B-03 can not memorize the material given by the teacher. The ability to apply strategy according to what the teacher has given is also not yet mastered by the subject of B-03. While to develop a different solution of the strategy provided by the teacher also can not be done by the subject of B-03.

Subject B-04 has achieved the ability of mathematical reasoning type Memorized Reasoning (MR) and Algorithmic Reasoning (AR). Based on this, the subject of B-04 has been able to memorize and implement problem-solving strategies according to what is given by the teacher well. But the subject of B-04 has not been able to develop a different solution of the strategy provided by the teacher.

2. Factors Caused The Difficulties of Student Mathematical Reasoning

The difficulty of mathematical reasoning of deaf students of SMPLB of Salatiga State is caused by several factors, namely:

- a. Limited vocabulary mastery.
- b. Teachers who have not mastered sign language to the fullest.
- c. Lessons learned do not facilitate students to be active and discover their own knowledge.

3. Growth Mathematical Reasoning Abilities

After discovering learning model assisted by student friendly teaching aids applied, each student has a new type of mathematical reasoning ability by retaining the initial ability type of mathematical reasoning as before that. Quantitative data analysis also shows this where the final test results of mathematical reasoning is better than the initial test of mathematical reasoning ability.

V. Conclusion

Based on the results of research on the implementation of discovery learning model assisted by student friendly aids to growth mathematical reasoning of hearing impaired grade VII in SMPLB NegeriSalatiga academic year 2017/2018, we can conclude that the characteristic of mathematical reasoning ability of SLB NegeriSalatiga student that is dominant is the type of memorised reasoning (MR) where the reasoning ability is still within the limits of memorizing the given material. Factors that cause difficulties in mathematical reasoning ability for deaf students are low vocabulary mastery of deaf students and teachers who have not mastered sign language. After the implementation of discovery learning model assisted by student friendly tools, the dominant mathematical reasoning ability appeared in the students of SLB NegeriSalatiga is memorised reasoning (MR) and algorithmic reasoning (AR). Based on the quantitative test obtained the conclusion of the data of the final test of mathematical reasoning ability more than the initial test results of mathematical reasoning ability. Based on the analysis of qualitative and quantitative data, it can be concluded that student-assisted learning discovery learning model can grow students' mathematical reasoning abilities in SLB NegeriSalatiga.

References

- [1]. Adebisi, R. O., & Liman, N. A. (2015). *Using Assistive Technology in Teaching Children with Learning Disabilities in the 21 st Century*. 6(24), 14-21.
- [2]. Arivina, A., Masrukan, & A. Prabowo. 2017. Ability Of Mathematical Reasoning in SMK 10th Grade with LAPS- Heuristic using Performance Assessment. *Unnes Journal of Mathematics Education*, 6(3): 318-324.
- [3]. Dewi, N., & Y. Kusumah. 2017. Implementation of Brain-Based Learning Web-Assisted to Improve Students Mathematical Reasoning. *UnnesJournal of Mathematics Education*, 6(1): 128 - 133.
- [4]. Hastuti, R. P., & Muhari. 2017. Increasing Procedure Text Reading Comprehension by Using the Saintific Approach of Pictural Media for Students with Hearing Impairment. *Jurnal Pendidikan dan Pengembangan Pendidikan Luar Biasa*, 4(2): 96-104.
- [5]. Hosnan, M. 2014. Pendekatan Sainifik dan Kontekstual dalam Pembelajaran Abad 21. Bogor: Ghalia Indonesia.
- [6]. In'am, A., & S. Hajar. 2017. Learning Geometry through Discovery Learning Using a Scientific Approach. *Internation Journal of Instruction*, 10 (1): 55-71.
- [7]. Lithner, J. 2008. A Research Framework for Creative and Imitative Reasoning. *Educational Studies in Mathematics*. 67(3): 255-276.
- [8]. Liu, J., & Xin, Y. P. (2017). The Effect of Eliciting Repair of Mathematics Explanations of Students with Learning Disabilities. *Learning Disability Quarterly*, 40(3), 132-145. <https://doi.org/10.1177/0731948716657496>
- [9]. Mariya, D., Zaenuri, & E. Pujiastuti. 2013. Keefektifan Pembelajaran Model Savi Berbantuan Alat Peraga terhadap Kemampuan Pemecahan Masalah. *Unnes Journal of Mathematics Education*, 2(2): 40-47.
- [10]. NCTM. 2000. Curriculum and Evaluation Standard for School Mathematics Reston: National Council of Teachers of Mathematics.
- [11]. PusatPenilaianPendidikan. n.d. *TIMSS Infographic*. Jakarta: BadanPenelitiandanPengembangan.
- [12]. Ramdhani, M. R., Usodo, B., & Subanti, S. (2017). Discovery Learning with Scientific Approach on Geometry. *Journal of Physics:*

- Conference Series. <https://doi.org/10.1088/1742-6596/895/1/012033>.
- [13]. Uzunboylu, H., & Özcan, D. (2019). Teaching methods used in special education: A content analysis study. *International Journal of Cognitive Research in Science, Engineering and Education*, 7(2), 99–107. <https://doi.org/10.5937/IJRSEE1902099U>.
- [14]. Wicaksana, H., & Usodo, B. 2016. Eksperimentasi Model Pembelajaran Problem Based Learning(PBL) dan Discovery Learning (DL) dengan Pendekatan Saintifik Pada Materi himpunan Ditinjau Dari Adversity Quotient (AQ) Siswa. *Jurnal Elektronik Pembelajaran Matematika*, 4(3): 256-269.

Sugiman, et. al. "Implementation of Discovery Learning Model with Student-Friendly Teaching Aids to Grow Mathematical Reasoning Ability SLB Students." *IOSR Journal of Research & Method in Education (IOSR-JRME)*, 10(3), (2020): pp. 01-05.