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# Analysis of Teacher Readiness in Teaching Mathematical Reasoning Skills

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**Abstract**
*Teachers as one of the main components in learning need to have good teaching readiness to teach mathematical reasoning skills in Elementary Schools. However, students' mathematical reasoning skills are currently still at a poor level. The objectives of this study include: 1) describing teacher readiness in mastering teaching materials, 2) describing teacher readiness in planning learning, and 3) describing teacher readiness in implementing learning assessments in Elementary Schools. This study is a qualitative study with an interactive analysis method. Mathematical reasoning ability comprehension tests in the form of questionnaires and semi-structured interviews were used to collect data. The results of the study showed that the mastery of teaching materials and learning planning owned by teachers related to mathematical reasoning abilities was at a good level. Meanwhile, teacher readiness in implementing assessments still showed a poor level. This is because teachers pay less attention to implementing mathematical reasoning assessments. In addition, teachers tend to prefer using multiple-choice tests. However, teachers are committed to improving their competence in order to be able to carry out assessments of mathematical reasoning abilities better. The conclusion of this study is that teacher readiness has shown a good level, but teachers need to improve their readiness in carrying out mathematical reasoning assessments.*
**Keywords:** *teacher readiness, mathematical reasoning, learning planning, mathematics*

**Abstrak**
Guru sebagai salah satu komponen utama dalam pembelajaran perlu memiliki kesiapan pengajaran yang baik untuk mengajarkan kemampuan penalaran matematis di Sekolah Dasar. Namun kemampuan penalaran matematis peserta didik saat ini masih dalam level kurang baik. Tujuan penelitian ini diantaranya yaitu untuk: 1) mendeskripsikan kesiapan guru dalam penguasaan bahan ajar, 2) mendeskripsikan kesiapan guru dalam merencanakan pembelajaran, dan 3) mendeskripsikan kesiapan guru dalam melaksanakan penilain pembelajaran di Sekolah Dasar. Penelitian ini merupakan penelitian kualitatif dengan metode analisis interaktif. Tes pemahaman kemampuan penalaran matematis berupa angket dan wawancara semi terstruktur yang digunakan untuk mengumpulkan data. Hasil penelitian menunjukkan bahwa penguasaan bahan ajar dan perencanaan pembelajaran yang dimiliki oleh guru terkait kemampuan penalaran matematis dalam tingkat yang baik. Sedangkan kesiapan guru dalam melaksanakan asesmen masih menunjukkan tingkat yang kurang baik. Hal tersebut dikarenakan guru kurang memberikan perhatian untuk melaksanakan penilaian penalaran matematis. Selain itu, guru cenderung lebih memilih menggunakan tes pilihan ganda. Namun, para guru berkomitmen untuk meningkatkan kompetensinya agar dapat melaksanakan penilaian tentang kemampuan penalaran matematis dengan lebih baik. Kesimpulan penelitian ini yaitu kesiapan guru telah menunjukkan tingkat yang baik, namun guru perlu meningkatkan kesiapan dalam melaksanakan penilaian penalaran matematis.
**Kata kunci:** *kesiapan guru, penalaran matematis, perencanaan pembelajaran, matematika*

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## 1. INTRODUCTION

Mathematics is one of the compulsory subjects for students at elementary school level (Ramlan & Hermawan, 2017). Mathematics is an important subject to be mastered by students because in everyday life, humans directly or indirectly implement their mathematical abilities. One of the important abilities that students must have in learning mathematics is mathematical reasoning ability. According to Sumartini, (2015) mathematical reasoning has an important role and is needed by students in concluding a statement and building new ideas to the stage of solving problems in mathematics. According to NCTM (National Council of Teachers of Mathematics), mathematics learning includes five basic mathematical abilities which are five process standards, namely problem solving, reasoning, communication, connection, and representation (Kurnia Putri et al., 2019). Based on this statement, mathematical reasoning ability is one of the mathematical abilities that needs to be developed in mathematics learning. In addition, mathematical reasoning skills are also needed by students in facing future challenges and keeping up with developments in the world of work (Vebrian, 2021).

However, the reality is that not all students have good mathematical reasoning skills. Based on the results of the 2022 PISA (Programme for International Student Assessment) study on 15-year-old students, it shows that the mathematical abilities of Indonesian students are still low or below the average of other countries. In the 2022 PISA mathematics assessment, the score decreased from 379 in 2018 to 366 in 2022 (OECD, 2022). So from this study it can be seen that there is a problem in the implementation of mathematics learning. The decline in Indonesia's PISA mathematics score is related to mathematical reasoning skills (Ariati, 2022). In addition, many people still think that mathematics learning is a difficult and difficult subject to learn (Anggraini, 2021). The decline in the PISA mathematics score and the assumption that mathematics is difficult to learn indicate that there are various factors that influence this, one of which is the readiness of teachers to teach mathematical reasoning in schools.

Teachers as one of the people who have the main role in teaching mathematics material in schools need to have an understanding and readiness to teach it in class, especially in teaching basic mathematical reasoning skills. This is because teachers are the ones who determine the learning model, learning methods, learning resources, and assessment of the learning carried out (Anggraini, 2021). In addition, teachers also have the responsibility for achieving predetermined learning objectives. The readiness of teachers in teaching mathematics, especially mathematical reasoning in class, can be seen through several indicators.

According to Sudjana (1999) there are several indicators of teacher readiness in teaching, including: 1) Mastering teaching materials, 2) Ability to diagnose student behavior, 3) Ability to carry out the learning process, and 4) Ability to measure learning outcomes. Meanwhile, according to Suwarna in (Fitriani, 2019) stated that teaching readiness includes several indicators, namely: 1) Readiness to plan and prepare learning, 2) Readiness to manage learning, 3) Readiness to carry out learning evaluations, and 4) Readiness to implement the four pillars of education. Based on these indicators, it can be concluded that if the selected indicators are used as a reference and implemented by the teacher optimally, then it can be said that the teacher has good teaching readiness, especially in teaching mathematical reasoning.

The teacher's readiness in teaching mathematical reasoning in class is expected to improve students' understanding better than before. In addition, teachers are also expected to be able to improve other basic mathematical abilities. Because if the teacher does not have the readiness and good understanding in teaching the material in class, it can cause confusion and even misconceptions for students in receiving the material presented by the teacher. Therefore, teachers need to pay attention to their readiness to teach, one of which is teaching mathematical reasoning skills.

The profile of students' mathematical reasoning ability based on the results of interviews with grade VI teachers at SD Negeri Karangasem obtained several pieces of information. First, around 40% of all students still have difficulty in performing arithmetic operations. Second, students experience difficulty or confusion when working on math problems that require mathematical reasoning, they do not know what to do. This happens especially to students who still have difficulty in performing arithmetic operations. Third, teachers still use simple questions to assess students' abilities. This is done to overcome excessive confusion and difficulty by students when working on problems on the material being studied. Based on the interview, it can be seen that students' mathematical abilities, especially mathematical reasoning skills, are still not good.

Teacher readiness in teaching mathematical reasoning in mathematics learning activities is important. Moreover, currently there is a change in the education curriculum from the 2013 curriculum to the Merdeka curriculum. At the beginning of the implementation of the Merdeka curriculum, there were many pros and cons among elementary school teachers. The reason is that teachers must learn the characteristics of the Merdeka curriculum and must adapt again to the new curriculum. This certainly has an impact on teacher readiness in teaching mathematical reasoning in schools. Therefore, to determine the level of teacher readiness in teaching mathematical reasoning, special research is needed in elementary schools regarding this readiness.

Research on teacher readiness in teaching mathematics in elementary schools has been widely conducted by previous researchers. The following are some previous studies that examine teacher readiness in teaching mathematics. The first is research conducted by Paulu et al., (2023) at Tilamuta 14 Public Elementary School. In their research on teacher readiness in learning mathematics, it was found that many students still had difficulty in calculating and memorizing multiplication. In addition, many students are not serious about participating in mathematics learning.

Another study was conducted by Anggraini (2021) regarding preparation in mathematics learning. In her study, Anggaraini (2021) found obstacles in the form of lack of activity and laziness of students in participating in mathematics learning. This is because students consider mathematics lessons to be difficult to learn. In line with the research conducted by Abidin et al., (2020) stated that students experience confusion in participating in mathematics learning activities caused by one factor, namely that students have not been facilitated in developing their mathematical reasoning skills. Based on the research results presented above, it can be seen that the mathematics skills of students in elementary schools are still lacking. This can be caused by various factors that influence it, both factors originating from the students themselves and from the teachers in learning. Therefore, the research that will be conducted focuses on teacher readiness in teaching mathematics, especially mathematical reasoning in elementary schools.

Teacher readiness in teaching mathematical reasoning can be seen from the level of teacher knowledge and mastery of mathematical reasoning itself. The level of teacher readiness in teaching mathematical reasoning can also be seen from the learning plan that has been prepared. Furthermore, teacher readiness in teaching mathematical reasoning can be seen from the assessment or evaluation of learning activities that have been carried out. Assessment activities can provide information to teachers regarding the level of student understanding and the level of achievement of learning objectives that have been determined at the beginning of learning. Therefore, this study aims to describe teacher readiness in teaching mathematical reasoning skills in Elementary Schools.

## 2. THEORETICAL

### 2.1 Mathematical reasoning

Mathematical reasoning is one of the basic skills that need to be developed and possessed by students in mathematics subjects (Kurnia Putri et al., 2019). Mathematical reasoning ability is reasoning about mathematical objects that are used to create or draw new statements that are true from previous statements that have been proven to be true (Kusumawardani, 2018). Sri Rahmawati (2021) states that mathematical reasoning is the ability to develop a thought process that supports a person's ability to build arguments or reasons based on known facts. Meanwhile, according to Nurharyanto (2023), mathematical reasoning is the ability to think in connecting one fact or information with another. Based on this explanation, it can be concluded that mathematical reasoning is the ability to think or reason to draw conclusions and make new statements from previously known mathematical object statements.

The mathematical reasoning ability possessed by students can help them in building new ideas, proving and concluding a statement, to the stage of solving problems in mathematics (Sumartini, 2015). Mathematical reasoning ability can also help students solve more complex problems (Ikashaum et al., 2021). Therefore, mathematical reasoning ability needs to be developed and improved by teachers for students in schools. This is done so that students have better mathematical reasoning ability and it is hoped that it can be useful for students in solving complex problems.

Mathematical reasoning according to Sumarmo in (Sumartini, 2015) mathematics learning has several indicators including: 1) drawing logical conclusions, 2) providing explanations with models, facts, properties, and relationships, 3) estimating answers and solution processes, 4) using patterns and relationships to analyze mathematical situations, 5) compiling and reviewing conjectures, 6) formulating opponents, following inference rules, checking argument validity, 7) compiling valid arguments, 8) compiling direct, indirect proofs, and using mathematical induction. Meanwhile, according to Linola et al., (2017) there are indicators of mathematical reasoning ability as follows: 1) carrying out manipulation, 2) the ability to present mathematical statements in writing, diagrams, and pictures, 3) compiling and providing reasons for the truth of the Solution, and 4) drawing logical conclusions from statements. So the indicators of mathematical reasoning in this study are: 1) Summarizing statements logically, 2) Finding and compiling mathematical conjectures, 3) Making valid statements or arguments, and 4) Ability to present mathematical statements.

### 2.2 Teacher readiness to teach mathematical reasoning

Teacher readiness in teaching material to students is an important thing to consider. Good teacher readiness in teaching material can help teachers to direct student behavior in learning and can influence student responses to teaching materials given by teachers (Wote & Sabarua, 2020). In addition, teaching readiness can also affect the effectiveness of learning carried out (Wahyudi, 2013). So it can be said that teacher readiness in teaching can affect learning activities and indirectly can also affect learning outcomes in students.

Teacher readiness in teaching needs to be considered so that the material taught can be delivered optimally, especially in teaching mathematical reasoning skills. According to Glaseer in (Sudjana, 1999) teacher readiness to teach can be known through several indicators including: Mastering teaching materials, ability to diagnose student behavior, ability to carry out the learning process, and ability to measure learning outcomes. Meanwhile, Suwarna in (Fitriani, 2019) stated that teaching readiness includes several indicators, namely: Readiness to plan and

prepare learning, readiness to manage learning, readiness to carry out learning evaluations, and readiness to implement the four pillars of education. Based on the indicators above, the indicators of teacher readiness in teaching mathematical reasoning in this study are: mastery of teaching materials, learning planning, and readiness to carry out assessments.

Readiness in general is a situation or condition of humans or the environment to do something in order to achieve certain goals (Syabrus, 2015). Meanwhile, according to Riinawati (2021), readiness is the ability to position oneself to do something. Readiness in teaching is related to a situation or condition of the teacher in carrying out teaching activities. Therefore, to carry out mathematical reasoning teaching, teachers need to have a good understanding. In addition, teachers also need good planning in teaching mathematical reasoning.

### 2.3 Research questions

The following research questions were used to guide the implementation of the research activities:

1. What is the level of teacher readiness in developing mathematical reasoning?

## 3. METHOD

### 3.1 Research Design

This study uses a descriptive qualitative research approach, namely research aimed at describing or describing existing phenomena, both engineered and natural, and paying more attention to characteristics, quality, and interrelationships between activities (Sukmadinata, 2019). This type of research was chosen because the researcher analyzed the readiness of teachers in teaching mathematical reasoning in the classroom.

### 3.2 Population and research sample

In this study, the population used was class teachers at Karangasem State Elementary School, Andong District, Boyolali Regency. The population of class teachers at SDN Karangasem was 6 people. Furthermore, sample collection used the total sampling technique. This means that all members of the population were used as samples in this study (Sugiono, 2016). The reason for using all members of the population as samples is the relatively small population, less than 30. In addition, the researcher wanted to make generalizations with very small errors.

### 3.3 Data collection tools

The tools used to collect data in this study were tests, questionnaires, and semi-structured interviews. The next step, data obtained from various sources were analyzed using data triangulation techniques to reduce bias or doubt and at the same time used to develop an understanding of the problems being studied (Haryoko, 2020). The questionnaire was developed by the researcher. The questionnaire was used to find information about teachers' understanding in teaching mathematical reasoning competencies in the classroom. Meanwhile, semi-structured interviews were used to obtain detailed information about teachers' readiness in readiness, planning, implementation, and assessment (assessment) in teaching mathematical reasoning. Furthermore, observations were carried out for the purpose of obtaining information about teachers' planning in teaching mathematical reasoning in the classroom.

### 3.4 Data analysis

The data obtained in this study were then analyzed through interactive analysis. Miles and Huberman said that interactive analysis is carried out by collecting data, reducing data, presenting data, and drawing conclusions (Rijali, 2019). At the data

collection stage, a mathematical reasoning ability comprehension test was used in the form of a questionnaire and semi-structured interviews. The collected data is then sorted, data that does not match the research needs will be reduced, while those that do will be presented in tabular form. Through tabular data presentation, data can be analyzed and conclusions can be drawn.

## 4. RESULTS

### 4.1 Level of teacher readiness in terms of mastery of mathematical reasoning teaching materials

To determine the readiness of teachers on the indicator of mastery of mathematical reasoning teaching materials, a test of 24 questions was used. The test result data is presented in Table 1 below.

**Table 1. Mastery Test Scores on Mathematical Reasoning Teaching Materials**

| Topic | Avarage |
|---|---|
| Understanding the Concept of Mathematical Reasoning | 81,25 |
| Understanding Prerequisite Material | 75,0 |
| Understanding Learning Materials | 87,5 |
| **Average** | **81,25** |

Based on Table 1, it is known that the mastery of mathematical reasoning teaching materials is at a high level with an average of 81.25. This shows that teachers have met one of the indicators of teacher readiness in teaching mathematical reasoning skills. The test results are reinforced by the teacher's statement as follows.

*"Of course sir, we have been teaching for several years so we are familiar with all the material in mathematics lessons."*

However, the test results on the indicator of understanding mathematical reasoning concepts obtained the lowest score compared to other indicators. The reason for the low results can be seen from the results of the following interviews with teachers.

*“Yes, because this term is rarely heard, sir. Luckily, I once studied about this mathematical reasoning concept when I was in college. So, I still remember it quite well.”*

### 4.2 Level of teacher readiness for mathematical reasoning learning planning indicators

To find out the teacher's readiness on the mathematical reasoning learning planning indicator, a questionnaire was used. The questionnaire contained five statements, the results of the questionnaire can be presented in Table 2 below.

**Table 2. Results of the Mathematical Reasoning Learning Planning Readiness Questionnaire**

| Topic | Avarage |
|---|---|
| Formulating learning objectives | 3,5 |
| Selecting and developing teaching materials | 3 |
| Formulating teaching activities | 3,5 |

| | |
|---|---|
| Planning media and learning resources | 3,5 |
| Planning assessments | 3 |
| **Average** | **3,3** |

Based on Table 2, it is known that the indicators of mathematics learning planning are at a high level with an average of 3.3. This shows that teachers have met one of the indicators of teacher readiness in planning mathematical reasoning learning.

However, they still find it difficult to determine the right learning media. This is because teachers feel that the material presented is abstract. The following are the results of an interview with subject 1 explaining this condition.

*"Yes, I have determined the learning media that will be used, sir. But I have difficulty determining the media to be used. Mathematics is abstract, sir, so making mathematics more concrete is difficult, sir."*

### 4.3 Level of readiness to carry out mathematical reasoning assessments

To determine teacher readiness on the mathematical reasoning assessment indicator, a six-statement questionnaire was used. The results of the questionnaire can be presented in Table 3 below.

**Table 3: Results of the Mathematical Reasoning Assessment Readiness Questionnaire**

| Topic | Avarage |
|---|---|
| Establish assessment objectives | 2,5 |
| Determine the form of assessment | 3 |
| Selecting an assessment technique | 2 |
| Arrange the grid | 2 |
| Prepare questions | 2 |
| Develop scoring guidelines | 1,5 |
| **Average** | **2,17** |

Based on Table 3, it is known that the indicator of readiness for implementing mathematical reasoning assessment is at a low level with an average of 2.17. This shows that teachers have not met one of the indicators of teacher readiness in implementing mathematical reasoning assessment. The results of the interview stated the factor of the low score of readiness to implement mathematical reasoning assessment.

*"Because I usually do the assessment at the end of the material, it sometimes ends up being too sudden in making it." (Subject 1)*

*“Yes, I rarely make story problems, sir. I usually write down arithmetic operations problems directly. Besides, is it because I usually use multiple choice questions, sir?”*

## 5. DISCUSSION

Mathematical reasoning is one of the basic abilities that need to be developed and possessed by students in mathematics subjects (Kurnia Putri et al., 2019). Mathematical reasoning ability is reasoning about mathematical objects that are used to create or draw new statements that are true from previous statements that have

been proven to be true (Kusumawardani, 2018). Therefore, the development of mathematical reasoning abilities should be prioritized by teachers in learning.

To prioritize the development of mathematical reasoning skills, teachers must be prepared to teach it. Teachers need to be well prepared in terms of mastery of teaching materials, learning planning, and carrying out assessments of mathematical reasoning teaching. Teachers' readiness and understanding of the concept of mathematical reasoning, prerequisite materials, and learning materials can help teachers direct student behavior in learning and can influence student responses to the teaching materials provided by the teacher (Wote & Sabarua, 2020). In addition, teaching readiness can also affect the effectiveness of the learning carried out (Wahyudi, 2013). The results of the study showed that teachers had a high level of mastery of teaching materials. With a high level of mastery of teaching materials, it will be easier for teachers to design learning to develop mathematical reasoning skills in students.

The level of readiness of learning planning also shows a high level. Teachers have formulated learning objectives. Teachers have developed teaching materials, designed learning steps and selected the learning media to be used. This is because teachers are the ones who determine the learning model, learning methods, learning resources, and assessment of the learning carried out (Anggraini, 2021). In addition, good learning planning will make the implementation of learning run well (Widiyanto, 2020). The implementation of good learning is because planning will be able to make learning take place systematically (Ananda & Amiruddin. 2019). Thus, teachers who have good readiness in the aspect of learning planning will have systematic learning and run better.

However, the readiness to carry out mathematical reasoning assessments shows a low level. This will certainly be detrimental to students. This is because effective assessments can provide meaningful and constructive feedback to students (Andayani & Madani, 2023). Therefore, the readiness to carry out mathematical reasoning assessments needs more attention. Teachers must be able and ready to carry out assessment activities such as setting assessment objectives, forms of assessment, assessment techniques, compiling grids, compiling questions and scoring guidelines used in assessment activities.

One form of teacher readiness to carry out mathematical reasoning assessments is determining assessment techniques. Teachers should use various assessment techniques. Because, by using a variety of assessment techniques will create a more positive and productive learning environment (Andayani & Madani, 2023). Thus, the use of a variety of assessment techniques is one of the things that teachers need to do to increase readiness in carrying out mathematical reasoning assessments.

## 6. CONCLUSION

Mathematical reasoning is one of the basic skills that is important to be developed by students in mathematics subjects. Mathematical reasoning has an important role and is needed by students in concluding a statement and building new ideas to the stage of solving problems related to mathematics. Therefore, teachers must prepare themselves in teaching mathematical reasoning so that students have good mathematical reasoning skills.

The results of this study indicate that the level of mastery of mathematical reasoning teaching materials is at a high level. The readiness to plan mathematical reasoning learning also shows a high level. However, the indicator of readiness to carry out mathematical reasoning assessments shows a low level. This is because teachers pay less attention to carrying out mathematical reasoning assessments. In addition, teachers tend to use short questions about arithmetic operations more often and rarely

use questions based on solving related problems. However, teachers are committed to improving their competence in order to carry out assessments of mathematical reasoning abilities better. The conclusion of this study is that teacher readiness to teach is one of the key factors in developing mathematical reasoning abilities.

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