Reducing Misconceptions of Elementary School Students Through Guided Inquiry Learning

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A B S T R A K

Beberapa siswa memiliki konsepsi mengenai konsep-konsep sebelum mereka mengikuti pelajaran di sekolah. Hal ini disebabkan karena kesalahpahaman siswa terhadap materi pembelajaran yang disampaikan oleh guru. Tujuan penelitian ini adalah menganalisis pengaruh model pembelajaran inkuiri terbimbing terhadap miskonsepsi siswa kelas lima di sekolah dasar. Jenis penelitian ini adalah penelitian eksperimen semu. Populasi penelitian ini berjumlah 43 siswa di sekolah dasar. Pemilihan sampel penelitian menggunakan multistage random sampling. Instrument yang digunakan untuk mengumpulkan data yaitu kuesioner. Teknik yang digunakan untuk mengumpulkan data yaitu dekriptif kualitatif dan kuantitatif. Hasil penelitian yaitu terdapat perbedaan yang signifikan miskonsepsi siswa antara kelompok siswa yang dibelajarkan dengan pembelajaran inkuiri terbimbing dan pembelajaran konvensional (F = 7,447; p<0.05). Miskonsepsi pada siswa yang belajar dengan pembelajaran inkuiri terbimbing lebih rendah dibandingkan siswa yang belajar dengan pembelajaran konvensional. Implikasi penelitian ini yaitu pembelajaran inkuiri terbimbing dapat digunakan oleh guru dalam pembelajaran untuk mengatasi miskonsepsi pada siswa.

A B S T R A C T

Some students have a conception of the concepts before they attend school lessons. It is because students are interested in the learning material delivered by the teacher. This study aimed to analyze the effect of the guided inquiry learning model on the misconceptions of fifth graders in elementary schools. This type of research is quasi-experimental research. The population of this study amounted to 43 students in elementary schools. The research sample was selected using multistage random sampling. The instrument used to collect data is a questionnaire. The technique used to collect data is descriptive qualitative, and quantitative. The study results showed significant differences in students' misconceptions between groups of students who were taught with guided inquiry learning and conventional learning (F = 7,447; p<0,05). Misconceptions in students who learn with guided inquiry learning are lower than who learn with conventional learning. This research implies that guided inquiry learning can be used by teachers in learning to overcome misconceptions in students.

1. INTRODUCTION

A teacher must distinguish between students who do not know the concept and students who have misconceptions. If the teacher cannot distinguish, it will be difficult for the teacher to find a solution to overcome students' misconceptions (Liu et al., 2020; Stellmacher et al., 2020). Besides that, it is also important for teachers to know students' misconceptions as input in designing learning (Bdiwi et al., 2019; Nurlaily et al., 2019). Conception is also termed as a person's embodiment or interpretation of an event or object. Because students themselves form their knowledge, it cannot be said that knowledge is wrong, but this knowledge is not by the views of experts and experts in their field (Agung, 2016; Mursalin, 2014). The results of the study stated that some students had conceptions of concepts before they took lessons at school (Adi & Oktaviani, 2019; Mursalin, 2014). It is due to the students' misunderstanding of the learning material delivered by the teacher (Negor et al., 2018; Yunitasari et al., 2019). Learning science in Indonesia in primary schools has not improved students' inquiry skills much (Ertikanto et al., 2017; Muliani & Wibawa, 2019).Other research also states that guided inquiry learning has increased the percentage of students who

know concepts to 54%, although there are still misconceptions by 35% of students (Fajarianingtyas & Yuniastri, 2015). Students' concepts are their knowledge, built through informal processes in understanding everyday experiences and is called prior knowledge or preconceptions (Li et al., 2021; Meriana et al., 2021; Shrestha & Jose, 2014). The students' preconceptions show that students' minds from birth are not silent but continue to be active to understand something. Children's minds continue to adjust to the situation they are experiencing to understand what they are experiencing in life.

One way that can be used to identify students' misconceptions is the CRI (Certainty of Response Index) method (Dede Trie Kurniawan & Maryanti, 2018; Sadh et al., 2017). CRI is the level of confidence or certainty of respondents in answering each question item. Students with high CRI reflect high confidence or certainty of concepts in answering questions, while students with low CRI indicate that answers are only based on guesses (Mustika et al., 2015; Widarti et al., 2016). Thus, students who have misconceptions and those who do not know the concept easily distinguish between schools (Adi & Oktaviani, 2019; Mursalin, 2014). Students who do not know the concept answer incorrectly with a low CRI, while students who have misconceptions answer incorrectly with a high CRI. According to the causal factors, misconceptions can be overcome by applying learning models/methods by the teacher. One of the learning models that can be used is guided inquiry learning (Gunawan et al., 2019; Husnaini & Chen, 2019; Margunayasa et al., 2019). Guided inquiry learning emphasizes the discovery process. Guided inquiry learning can be interpreted as a teaching method that allows students to move step by step from problem identification, defining hypotheses, problem formulation, data collection, results in verification, and generalization to drawings towards conclusions (Anjelina & Mawardi, 2021; Leonard & Nwanekezi, 2018; Stender et al., 2018). The guided inquiry learning model has advantages so that it can reduce students' misconceptions. The advantage of the guided inquiry learning model is that it provides space for students to learn according to their cognitive style (Arantika et al., 2019; Pratono et al., 2018). In addition, this learning model can serve the needs of students who have above average abilities (Taruh et al., 2019; V. A. Wahyuni et al., 2019). The inquiry learning model is considered by the development of modern psychology, which considers learning as a process of change and can create meaningful learning because it develops cognitive, affective and psychomotor aspects in a balanced way (Ari Astuti et al., 2019; Kuala, 2020; Washington, 2019).

The position of inquiry learning in the curriculum is very strategic. Even in the 2013 curriculum, it is expressly stated that inquiry learning is one of the contextual learning models that can be used to support scientific approaches (Athanases et al., 2020; Santiasih et al., 2013). The findings of previous studies also state that guided inquiry learning can reduce students' misconceptions (Kohar et al., 2017; Witanecahya & Jatmiko, 2014). It can be concluded that the inquiry learning model can reduce misconceptions in students. This study aimed to analyze the effect of the guided inquiry learning model on the misconceptions of fifth-grade elementary school students in Singaraja City on the light material. It is hoped that this learning model can help students in learning to reduce misconceptions in students.

2. METHOD

This type of research is quasi-experimental research. The research population is 43 public elementary schools in Singaraja City, Bali. The research sample was selected using multi-stage random sampling, consisting of 4 elementary schools (n = 60) for the experimental group and four elementary schools (n = 63) for the control group. The experimental group learns through guided inquiry learning, and the control group learns through conventional learning. Students' misconceptions data were collected using a science learning outcome test instrument on the nature of light material in the form of multiple-choice (reliability = 0.89) with a grid-like Table 1. Light material was chosen because the research results of Haslag and Concannon (2012) stated that many students have misconceptions about light when they are just starting to enter junior high school, and it is the teacher's responsibility to find activities that can reduce misconceptions/ideas.

Table 1. Grid of Science Learning Outcomes for Material Properties of Light

concept	Question item number
The nature of light travels in a straight line	1,2,3,4
The nature of light penetrating clear objects	5,6,7
Characteristics of the image formed by plane, concave, and convex mirrors	8,9,10,11
The nature of light can undergo refraction	12
The nature of light can undergo decomposition.	13,14

The Certainty of Response Index (CRI) technique can identify students' misconceptions. CRI provides a measure of the level of certainty or level of confidence in answering each question. The measure

of the level of confidence is expressed on a Likert scale. CRI was developed using a scale of six (0-5) (Hasan et al., 1999). When students answer each of the multiple-choice questions, students are asked to fill in the CRI level between 0 and 5. A scale of 0 states that students have no knowledge or total guesswork, while a scale of 5 states that students are very confident in their knowledge when answering.

3. RESULT AND DISCUSSION

Result

Based on the answers to each question and the level of CRI filled out by students, students can be categorized into lucky students or total guesses (TM), students who do not know the concept (TTK), students who know the concept (TK), and students who have misconceptions. (MK). Based on data analysis, the number of students for all indicators who experience misconceptions in the experimental group is 168 out of 840 (20%), while in the control group, as many as 235 out of 882 (26.6%). Most misconceptions occur in the material "the nature of the image formed by flat, concave, and convex mirrors", where the experimental group is 30.4%, and the control group is 38.9%. The least misconceptions occurred in the material "The nature of light propagates in a straight line" in the experimental group 6.3% and the control group 11.9%. The guided inquiry learning model is effective in reducing students' misconceptions compared to conventional learning. Furthermore, the data on students who total guessed (TM), did not know the concept (TTK), knew the concept (TK), and misconceptions (MK) in the experimental group for all items. Based on the results of data analysis, it is known that the number of students in the experimental group who experienced the most misconceptions occurred in items number 8, 10, 11, and 12. At the same time, the number of students who experienced the least misconceptions was in items number 1 and 2. Furthermore, the total student data was displayed. guess (TM), do not know the concept (TTK), know the concept (TK), and the misconception (MK) in the control group.

Based on the results of data analysis, the number of students in the control group who experienced the most misconceptions occurred in items number 7, 8, 9, 10, and 11. At the same time, the number of students who experienced the least misconceptions was in items number 1 and 2. prerequisite analysis through normality test and homogeneity of data distribution. Data distribution normality test using Kolmogorov-Smirnov test through SPSS 16.0 for the experimental group obtained a statistical value of 0.112 with a significance of 0.06 (p>0.05), and for the control group, a statistical value of 0.076 with a significance of 0.08 (p>0.05) was obtained.). The results of this test indicate that the data distribution of students' misconceptions in the experimental group and the control group is normally distributed. Furthermore, the results of the homogeneity test of misconception data through Levene Statistics show a statistical value of 1.949 with a significance of 0.165 (p>0.05). Hypothesis testing in this study was conducted by analysing variance through SPSS 16.0, obtaining an F value of 7.447 with a significance of 0.01 (p <0.05), which means the variance is homogeneous. These results indicate that the null hypothesis, which states "there is no difference in students' misconceptions between those who study with the guided inquiry model and those who learn with the conventional", is rejected. There are differences in students' misconceptions between those who study with a guided inquiry model and those who learn with conventional. The average misconceptions of students who study with the guided inquiry model are smaller than those of students who learn conventionally.

Discussion

The results showed that the guided inquiry learning model effectively reduced misconceptions experienced by students compared to conventional learning. The guided inquiry learning model provides a good atmosphere for creating student-centred learning (Suparmi, 2019; Suryantari et al., 2019). The inquiry learning model provides opportunities for more student-centred learning (Carlucy et al., 2018; Nurmayani et al., 2018).Student-centred learning allows students to be more involved in learning (Ruqoyyah et al., 2020; R. Wahyuni et al., 2017). The greater the involvement of students in the teaching and learning process, the greater their learning abilities and the effect on student learning outcomes (Fitriyati & Munzil, 2017; Siagian & Simatupang, 2017). By increasing student learning outcomes means that students experience misconceptions. Another thing will be very different if the learning applied is more teacher-centred. It can lead to less student involvement in learning (Bressington et al., 2018; Hwang et al., 2020). Little student involvement in learning certainly causes the learning to be less meaningful for students (Chai & Kong, 2017; Clay et al., 2021). Less meaningful learning is one of the causes of students' misconceptions. Learning through discovery strongly supports student-centred learning. Through inquiry, it gives freedom to students by encouraging them to have a more active and responsible role in various stages of investigation (Angela, 2014; Chai & Kong, 2017). Inquiry-based learning places special emphasis on cognitive learning and discovery and the goal of developing higher-order thinking (Brown et al., 2021; Pratiwi et al., 2016).

The inquiry learning model is recommended for learning through discovery. In other words, the teacher does not teach everything directly or explicitly.

Learners are expected and encouraged to discover knowledge, generate rules based on a series of activities, and better apply these rules or knowledge to new cases and deal with everyday life situations (Anjelina & Mawardi, 2021; Febriana et al., 2018; Kuala, 2020). Thus, misconceptions will not occur during the learning process. Through this learning, students can know and find the correct concept (Cooper et al., 2020; Laksana et al., 2019). In inquiry learning, the teacher becomes a facilitator to help students explore and find concepts to make learning more challenging. The advantages of inquiry learning are allowing students to think, thinking carefully, creating space for students to participate fully to increase curiosity (Kusumah et al., 2020; Purwanita et al., 2019). It certainly can improve understanding of processes, concepts and relationships between concepts and keep students' misconceptions away. The findings of previous studies also state that the inquiry learning model can improve student learning outcomes (Rosidin et al., 2019; Tan, 2021; Taruh et al., 2019). The guided inquiry learning model is very relevant to be applied to elementary school students. However, in general, the principles of conducting guided inquiry are no different from other inquiry forms. The word "guided" only means that elementary school students must be guided when carrying out activities, not left to do activities. It is done with the aim of students being able to achieve their goals by minimizing errors. If this can be achieved, then it will be a big capital to carry out other inquiries. The word "guided" also does not mean that everything is based on teacher guidance, but little by little, the guidance will be reduced so that students can carry out modified inquiries and even open inquiries one day.

4. CONCLUSION

Guided inquiry learning is effective in reducing students' misconceptions compared to conventional learning. Guided inquiry learning steps allow students to act as experts in finding concepts. Teachers can use guided inquiry learning in overcoming misconceptions experienced by students. However, before learning begins, the teacher should first identify the misconceptions experienced by students. Teachers can use the CRI method to identify students' misconceptions.

5. REFERENCES

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