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Analysis of elementary school students' misconceptions on magnetism using certainty of response index method

Khalimatus Syarivah [1], Nur Ngazizah [2], and Titi Anjarini [3]
[1,2,3] Elementary School Teacher Education Study Program, Faculty of Teacher Training and Education, Muhammadiyah University of Purworejo, Purworejo, Indonesia

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Abstract

Understanding key scientific concepts is vital for elementary students, yet misconceptions are common. This study identifies misconceptions about magnetism among sixth-grade students at SDN Muhammadiyah Purworejo using the Certainty of Response Index (CRI) method. Involving 33 fourth-grade students, the research employed a qualitative case study approach with CRI-based diagnostic tests. Responses were categorized into four groups: "guessing," "understanding the concept," "not understanding the concept," and "misconceptions." Results showed the highest misconceptions in how to make a magnet, followed by the magnetic field, understanding magnets, magnetic poles, and distinguishing magnetic from non-magnetic objects, with the lowest misconceptions in the application of magnets in daily life. The study highlights the need for effective teaching strategies to address these misconceptions and improve students' understanding of magnets.

INTRODUCTION

Background of the Study

Science (Ilmu Pengetahuan Alam) is a crucial subject at the elementary school level, aimed at fostering insight and understanding of scientific concepts that can be applied daily (Danial et al., 2021). The topic of magnetism is particularly relevant and interesting for students. Key concepts taught at this level include the properties of magnets, magnetic poles, and the interactions between magnets and other objects (Latif et al., 2021). However, it is common for students to encounter misconceptions related to this material. Such misconceptions can hinder their understanding of more complex science concepts in subsequent levels of education (H. E. Putri et al., 2021).

An important material in science teaching and learning activities in elementary schools is the concept of magnetism. Proper knowledge of magnetism is essential since it serves as the foundation for investigating numerous natural phenomena and implementing technology in everyday life (Abdusselam & Karal, 2020). However, students frequently face difficulties in learning numerous parts of science (IPA), including magnetism. These challenges might lead to misconceptions, which are understandings that do not align with the scientific principles agreed upon by several experts. At the next level of education, misconceptions about magnetic materials can make it more difficult for students to understand more complex scientific topics (H. E. Putri et al., 2021). Misconceptions in science subjects generally occur because students have difficulty distinguishing the concepts of their subchapters.

Misconceptions about science affect not just low-ability students, but also high-ability students, and both male and female students realize that the more it is sharpened, the better it will become (Faizin et al., 2022). This is due to various factors, including inaccurate prior knowledge, inappropriate learning methods, and the complexity of the material presented (Potvin, 2023). Students' prior knowledge gained from daily practice often conflicts with abstract scientific concepts, making it difficult to understand new material (Nasrudin & Azizah, 2020). Furthermore, context-related issues include the students' lack of confidence in communicating with the teacher, as well as the teacher's teaching approaches (Maryani & Atmojo, 2024).

The Problem of the Study

The results of research observations at SD Muhammadiyah Purworejo found that students often have difficulty understanding concepts in learning. Misconceptions generally occur because students have difficulty distinguishing the concepts of their sub-chapters. The results align with a study that found misunderstandings are still quite common at the elementary school level (Nurfiyani et al., 2020). Another factor contributing to these misconceptions is the use of inadequate learning aids, leading to students having an unclear understanding of certain concepts. This issue is characterized by misconceptions that arise from an inaccurate interpretation of the material.

Research's State of the Art

Several previous studies have investigated student misconceptions regarding magnetic materials. Nurfiyani et al., (2020) found that elementary school students retain misconceptions about the concept of magnetic force, with a misconception rate of 45.6%. Additionally, the use of the three-tier test method to identify student misconceptions in magnetism revealed that 38.2% of students experienced misconceptions (Shofiyah, 2021). To identify misconceptions more effectively, the "Certainty of Response Index" (CRI) approach has proven to be beneficial. This method not only assesses students' understanding of concepts but also evaluates their confidence in the answers they provide (Latif et al., 2021). Several researchers have utilized the CRI method to pinpoint misconceptions. For instance, (Suprapto, 2020) employed CRI to analyze students' misconceptions related to mechanical wave material.

Novelty, Research Gap, & Objective

The novelty of this research lies in analyzing the misconceptions that elementary school students hold about magnetism using the Certainty of Response Index (CRI) approach. While the analysis of misconceptions has been widely studied, there has been limited research specifically on magnetic materials using the CRI method. This study aims to utilize the CRI technique to identify the misconceptions held by sixth-grade students at SD Muhammadiyah Purworejo regarding magnetic materials. It is believed that this research will provide a more comprehensive understanding of the misconceptions related to magnetism, which can serve as a foundation for developing more effective teaching methods to boost students' confidence in their responses.

METHOD

Type and Design

This research uses a qualitative case study approach combined with the CRI (*Certainty of Response Index*) method. This approach does not require mathematical calculations, but because it is combined with the CRI method, there are mathematical calculations in the data analysis by the CRI method. The primary aim of this method is to conduct an in-depth examination of students' confidence levels regarding misconceptions related to magnetic materials when they complete the CRI multiple-choice test. The study involved 33 sixth-grade students from SD Muhammadiyah Purworejo. Participants were selected through purposive sampling, considering that these students have comprehensively studied the topic of magnetic materials (Latif et al., 2021).

Data and Data Sources

This research uses data from observations, interviews, and documentation of CRI (Certainty of Response Index) based diagnostic test results at SD Muhammadiyah Purworejo. In addition, this research also used literature studies related to elementary school students' misconceptions about magnetism through the CRI (Certainty of Response Index) approach from previous studies that were used as additional references, such as Sinta or Scopus reputable scientific journals and other relevant government publications.

Data Collection Technique

The data collection method used in this study employs qualitative techniques, including observation, interviews, and documentation of results from the CRI (Certainty of Response Index) based diagnostic test. The test instrument consists of 16 multiple-choice questions, each offering four alternative answers that cover fundamental concepts of magnetism. Additionally, each question is accompanied by a CRI scale ranging from 0-5 to measure the level of student confidence in their chosen responses. These observations complement data from diagnostic tests and interviews and provide a comprehensive picture of how students learn and interact with the concept of magnets in the classroom (Anam & Fadilah, 2021). The interview instrument aims to classify students' answers in the diagnostic test and explore the reasons behind the answers that show misconceptions. Interviews provide flexibility in examining students' reasoning in more depth.

Data Analysis

The process of data analysis using qualitative techniques begins with data reduction, which is followed by presentation, verification, and summarization. Data reduction involves categorizing student responses derived from documentary evidence, specifically diagnostic test results, based on the accuracy of the answers and the CRI scale assigned. Student understanding is classified into four categories: "guessing," "understanding the concept," "not understanding the concept," and "misconception." The criteria for categorization are based on the method developed (Rahma et al., 2018) as outlined in Table 1.

Table 1. CRI Value and Criteria

Nilai CRI	Criteria
0	Guessing
1	Almost Guessing
2	Not Sure
3	Sure
4	Almost Correct
5	Correct

Table 2. CRI Analysis

Answer Criteria	CRI Level	Analysis
Correct	0-2 (low)	Guessing (MN/Menebak)
correct	3-5 (high)	Understanding the Concept (PK/Paham Konsep)
Incorrect	0-2 (low)	Don't Know the Concept (TTK/Tidak Tahu Konsep)
incorrect	3-5 (high)	Misconseptioning (M/miskonsepsi)

The percentage of students for each category of understanding was calculated using the formula below:

$$P = \frac{f}{N} \text{ x } 100\%$$

Description:

P = percentage of students in each category

f = number of students in each category

N = total number of students in each category (who were used as research subjects)

After obtaining the calculation of the percentage of misconceptions, then the problem is classified into the evaluation categories below.

Table 3. Percentage Misconception

Percentage	Category
0% - 30%	Low
31% - 60%	Middle
61% - 100%	High

Additionally, analyze each student's response and align it with what they expressed during the interview . Interviews were analyzed using thematic analysis techniques to identify patterns and themes that emerged from students' responses regarding their misconceptions. Data from the interviews were used to explore the misconceptions identified through the diagnostic test and provide a more detailed explanation of the reasons behind the misconceptions. Of course, this is done to validate the suitability between students' misconceptions and students' answers conveyed during the interview so that later a conclusion can be obtained about what misconceptions occur in class IV students when learning magnetic material through multiple-choice objective tests and CRI. Observation data is analyzed to see how students interact with learning materials in the classroom. This observation will provide an overview of how the learning process can affect students' understanding of the concept of magnetism and how it relates to the emergence of misconceptions (Anam & Fadilah, 2021).

RESULTS

Based on data analysis using the CRI method. This study problem shows that there are students feeling misconceptions about the magnetic material. The following is a graph of the percentage of students' concept understanding results on magnetic material.

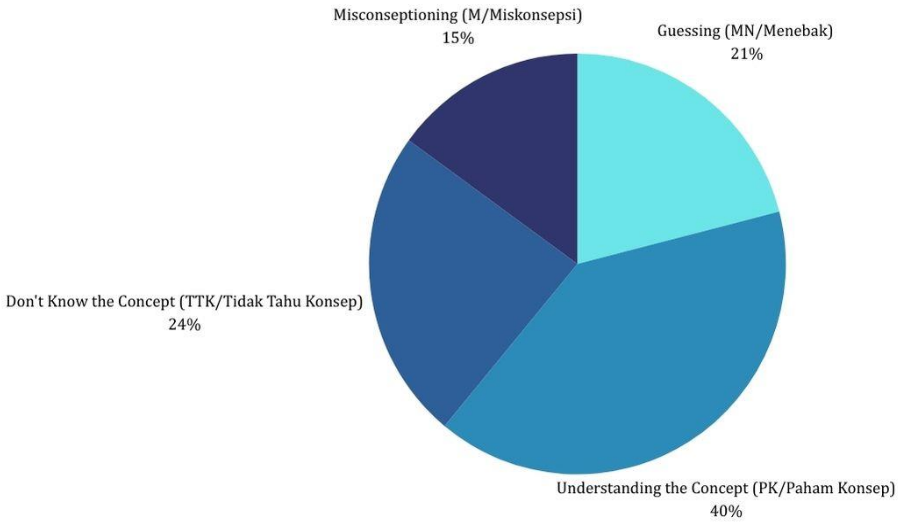


Figure 1. Percentage of Students' Concept Understanding

This issue is consistent with a study conducted by (Nurfiyani et al., 2020) which found that misconceptions about magnetic force are still relatively high among elementary school students. Referring to Figure 1, it can be noted that in response to magnetic questions, grade VI students showed the following percentages: 21% of students were merely "guessing," 40% "understood the concept," 24% "didn't know the concept," and 15% exhibited "misconceptions." Jadi presentase pemahaman konsep siswa yang miskonsepsi lebih rendah daripada yang paham konsep, namun hampir semua indikator soal siswa mengalami miskonsepsi. Further analysis was conducted to identify misconceptions on each magnet sub-concept. The problem of the analysis can be observed in Table 4 below.

Table 4. Percentage of Student Diagnostic Test Results with CRI

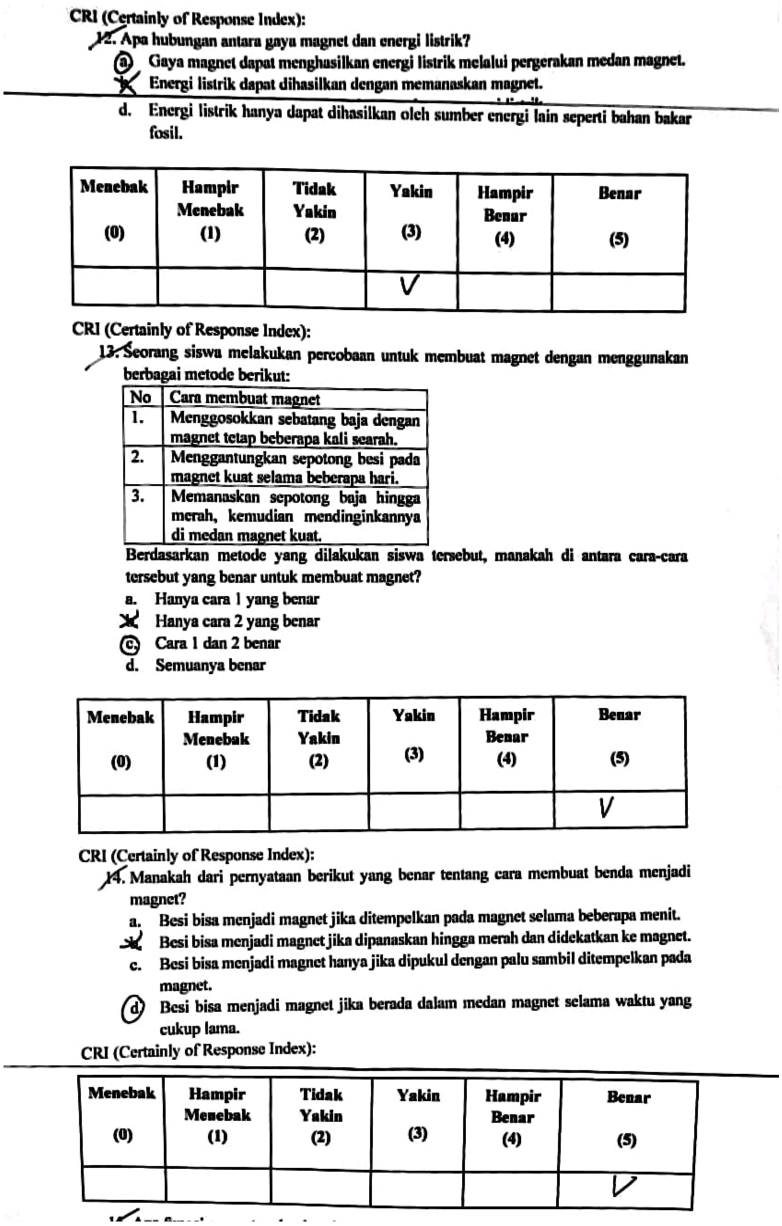
Question Number	Question Indicator	MN	PK	TTK	M
1.	Explain the definition of magnetism and its characteristics.	24%	25%	18%	33%
2.	Identify the types of magnets, including natural and artificial magnets.	27%	55%	9%	9%
3.	Identify the strength of magnetic attraction.	24%	16%	36%	24%
4.	Explaining the concept of north and south poles in magnets.	18%	19%	45%	18%
5.	Identifying magnetic poles that attract and repel each other.	24%	45%	16%	15%
6.	Mentioning materials that can be attracted by magnets.	30%	21%	18%	31%
7.	Classify materials based on magnetic attraction.	3%	88%	6%	3%
8.	Analyzing the interaction of magnets with various materials.	24%	37%	30%	9%
9.	Describe the magnetic field and magnetic lines of force.	15%	0%	58%	27%
10.	Explaining how a magnetic field is formed around a magnet.	24%	9%	52%	15%
11.	Explain the effect of the magnetic field on surrounding objects.	9%	9%	55%	27%
12.	Explaining the relationship between electrical energy and magnetism.	30%	21%	34%	15%
13.	Identify ways to make magnets, such as rubbing, induction, and using electric current.	6%	9%	55%	30%
14.	Analyze the process of making a simple magnet.	21%	15%	40%	24%
15.	List the uses of magnets in everyday life, such as compasses, electric motors, and electronic devices.	15%	64%	6%	15%
16.	Explain the benefits of magnets in technology and industry.	27%	36%	25%	12%
	Total	21%	40%	24%	15%

According to Table 4, which outlines students' misconceptions about magnetic materials based on compiled indicators, the results for grade VI students indicate the following: 15% of students experience misconceptions, 24% do not understand the concept, 40% have a correct understanding, and 21% resort to guessing. Although the 15% misconception rate in magnetic materials can be categorized as low, nearly all indicators show that students are experiencing misconceptions. These findings align with the research conducted by (Shofiyah, 2021), which found that 38.2% of students experienced misconceptions. Additionally, Table 5 provides a breakdown of the number of students experiencing misconceptions in each sub-chapter.

Tabel 5. Total Miskonsepsi pada setiap Sub-Konsep Magnet

Sub-Concept	Percentage
How to make a magnet	23%
Magnetic field	23%
Definition of magnet	22%
Magnetic poles	16,5%
Magnetic and non-magnetic objects	13,5%
Application of magnets in everyday life	13,5%

Referring to Table 5, it can be seen that the results of the CRI-based diagnostic test found that grade VI students of SD Muhammadiyah Purworejo experienced misconceptions in various sub-concepts in magnetic material. The most dominant misconception is in the sub-concept of how to make a magnet (figure 2), where as many as 23%. With an average CRI above 3,4,5, students felt very confident in their answers, even though they were wrong. This indicates that they have misconceptions and need in-depth learning interventions (Latif et al., 2021).



CRI (Certainly of Response Index):

12. Apa hubungan antara gaya magnet dan energi listrik?

a. Gaya magnet dapat menghasilkan energi listrik melalui pergerakan medan magnet.

b. Energi listrik dapat dihasilkan dengan memanaskan magnet.

d. Energi listrik hanya dapat dihasilkan oleh sumber energi lain seperti bahan bakar fosil.

Menebak (0)	Hampir Menebak (1)	Tidak Yakin (2)	Yakin (3)	Hampir Benar (4)	Benar (5)
			V		

CRI (Certainly of Response Index):

13. Seorang siswa melakukan percobaan untuk membuat magnet dengan menggunakan berbagai metode berikut:

No	Cara membuat magnet
1.	Menggosokkan sebatang baja dengan magnet tetap beberapa kali searah.
2.	Menggantungkan sepotong besi pada magnet kuat selama beberapa hari.
3.	Memanaskan sepotong baja hingga merah, kemudian mendinginkannya di medan magnet kuat.

Berdasarkan metode yang dilakukan siswa tersebut, manakah di antara cara-cara tersebut yang benar untuk membuat magnet?

a. Hanya cara 1 yang benar

b. Hanya cara 2 yang benar

c. Cara 1 dan 2 benar

d. Semuanya benar

Menebak (0)	Hampir Menebak (1)	Tidak Yakin (2)	Yakin (3)	Hampir Benar (4)	Benar (5)
					V

CRI (Certainly of Response Index):

14. Manakah dari pernyataan berikut yang benar tentang cara membuat benda menjadi magnet?

a. Besi bisa menjadi magnet jika ditempelkan pada magnet selama beberapa menit.

b. Besi bisa menjadi magnet jika dipanaskan hingga merah dan didekatkan ke magnet.

c. Besi bisa menjadi magnet hanya jika dipukul dengan palu sambil ditempelkan pada magnet.

d. Besi bisa menjadi magnet jika berada dalam medan magnet selama waktu yang cukup lama.

CRI (Certainly of Response Index):

Menebak (0)	Hampir Menebak (1)	Tidak Yakin (2)	Yakin (3)	Hampir Benar (4)	Benar (5)
					V

Figure 2. Number of questions 12,13,14

In the picture 2. Questions 12, 13, and 14 reveal misconceptions where students answered incorrectly but displayed a high level of confidence, scoring between 3 and 5. Additionally, in the sub-concept of magnetic poles (see Figure 3), students struggled to grasp the idea that "poles of the same type repel each other, while poles of different types attract each other." The percentage of misconceptions identified was 16.5%, and only 10 students were able to answer correctly with a high confidence rating CRI, which indicates a solid understanding of the concept

CRI (Certainly of Response Index):

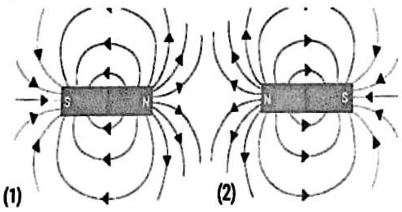
4. Apa yang dimaksud dengan kutub selatan pada magnet?

a. Bagian magnet yang menunjuk ke utara
b. Bagian magnet yang menunjuk ke selatan
c. Bagian magnet yang berwarna biru
d. Bagian magnet yang tidak mempengaruhi arah kompas

Menebak (0)	Hampir Menebak (1)	Tidak Yakin (2)	Yakin (3)	Hampir Benar (4)	Benar (5)
			✓		

CRI (Certainly of Response Index):

5. Perhatikan gambar berikut!



Apa yang akan terjadi jika dua kutub utara magnet didekatkan satu sama lain?

a. Magnet 1 menolak magnet 2
b. Magnet 1 menarik magnet 2
c. Tidak ada interaksi yang terjadi antara magnet 1 dan 2
d. Mereka akan berputar mengelilingi satu sama lain

Menebak (0)	Hampir Menebak (1)	Tidak Yakin (2)	Yakin (3)	Hampir Benar (4)	Benar (5)
			✓		

Figure 3. Questions number 4 and 5

Based on the results of Figure 3. Problems 4 and 5 both exhibit misconceptions where students answer incorrectly despite having a high level of confidence, rated at 3-5. One contributing factor to these misconceptions is the insufficient use of learning aids, which prevents students from fully understanding magnetic concepts. To address these misconceptions, an inquiry and experiment-based approach is necessary. This method allows students to directly interact with magnets and various magnetic and non-magnetic objects, helping them gain a clearer understanding (H. E. Putri et al., 2021).

This research confirms that interactive and contextualized learning strategies are essential for helping students correct their misconceptions. Methods such as inquiry-based learning and hands-on experiments enable students to independently discover concepts, strengthen their understanding, and eliminate misconceptions (Shofiyah, 2021).

DISCUSSIONS

Misconceptions in education refer to misunderstandings that arise when students have an inaccurate grasp of specific concepts. In science learning, these misconceptions can obstruct the learning process and hinder students' ability to apply concepts in real-life situations (Nurfiyani et al., 2020). Such misconceptions often stem from inadequate previous experiences or ineffective teaching methods, causing students to carry these misunderstandings into new topics.

Based on the analysis that has been done, the concept of magnetic material can be categorized as low, but almost all indicators of students experiencing misconceptions in the subchapter on how to make a magnet, namely 23% of students who experience misconceptions. The results of observations and interviews that have been conducted show that there is a misunderstanding of students' knowledge so students experience misconceptions. Misconceptions can occur because the teacher's mistake in delivering a material will also be fatal for students. Especially if the source of information is pegged to the teacher alone and students do not have the opportunity to express ideas or ask questions related to their understanding. This is what causes misconceptions in students to increase.

Causes of Misconceptions

The causes of misconceptions about magnetic materials among students can vary. Based on (Didik et al., 2020) several factors that are the main causes of misconceptions include:

1. Incorrect Personal Experience: Students often bring inappropriate understandings from everyday life into the classroom. For example, the assumption that all metal objects can be attracted by magnets is a result of limited observations around them.
2. Inappropriate Curriculum or Learning Resources: Incomplete learning materials or in-depth delivery can prevent students from gaining correct understanding. A curriculum that is too theoretical and does not provide real-life experiences can also exacerbate misconceptions.
3. Difficulty in Differentiating Similar Concepts: Many students have difficulty distinguishing closely related concepts, such as the difference between magnetic and non-magnetic objects or how magnetic poles work. This can lead to ongoing misconceptions if not corrected.
4. Less Interactive Learning Methods: One-way learning, where students only receive information from the teacher without any further exploration or

experimental activities, tends to make students unable to understand concepts in depth. The absence of hands-on experiments with magnets in the classroom also contributes to the emergence of misconceptions.

Impact of Misconceptions

The impact of misconceptions in science education is significant. These misconceptions can obstruct students' understanding of advanced concepts, as they often cling to incorrect beliefs even when presented with accurate information (Halim et al., 2018). Not only that, misconceptions can cause low motivation to learn, because students may feel less confident when the concepts they believe to be correct turn out to be wrong. The solution that can be given is that teachers can utilize interactive, innovative, and creative teaching and learning media in the learning process (Maryani & Atmojo, 2024).

Certainty of Response Index (CRI)

CRI is a method used to analyze students' levels of confidence in their responses to diagnostic tests. This approach measures not only whether an answer is correct or incorrect, but also the degree of confidence the student has in their response. By employing CRI, educators can determine whether students genuinely understand the concepts they are addressing or if they are simply guessing. The CRI is scored on a scale of 0 to 5: low scores indicate uncertainty or guesswork, while high scores reflect strong confidence in the accuracy of the answer. When students answer with high confidence but are incorrect, it suggests the presence of a misconception. (Ukoh, 2022).

By measuring the level of students' confidence in their responses, the CRI technique helps to find misconceptions in students, not only seeing the right and wrong answers but also seeing the extent of students' confidence in their understanding, so that misconceptions can be identified accurately (Fantiani et al., 2023). With CRI, teachers can find out whether students answer correctly because they understand the concept or just guess, and know the level of misconceptions that occur (Kasanah & Setiyawati, 2024). This method provides a more in-depth approach to measuring students' understanding and helps teachers in designing more effective learning interventions (Ukoh, 2022).

Misconceptions on How to Make a Magnet

Although the sub-concept "how to make a magnet" showed 23% misconceptions, this issue still needs attention. A common misconception found is the assumption that magnets can only be made by rubbing. As stated by (Eren, 2021) magnets can also be created through induction and electromagnetic stages.

To overcome this misconception, the use of interactive learning media can be an effective solution. In their research (Fauziah et al., 2021) on the effect of fun learning on elementary school students' attitudes towards science, found that the application of interactive media can foster students' understanding of abstract concepts in science. They suggested using computer simulations or *augmented* reality applications to help students visualize the process of making magnets that are difficult to observe directly (Ukoh, 2022).

When teaching about how to make magnets, teachers can use interactive simulations that demonstrate different methods, including induction and electromagnetic. In addition, a simple practicum where students try to make magnets using various methods can also help reinforce their understanding (Ukoh, 2022).

Misconceptions on the Definition of Magnetism

The highest misconception was found in the definition of magnet sub-concept, with 22%. This problem indicates that most students still find it difficult to understand the basic characteristics of magnets. The most common misconception found was the assumption that all metals can be attracted by magnets (Didik et al., 2020). This result is relevant to a study conducted by (Shofiyah, 2021) who identified similar misconceptions in secondary-level students. In her research, she found that many students still assume that all metals are magnetic. This misconception may stem from the overgeneralization of students' daily observations, where they often see magnets attracting different types of metals without understanding the differences in the magnetic properties of each metal (Latif et al., 2021).

To overcome this misconception, it is necessary to apply a more effective learning strategy. Effective learning strategies can be carried out by teachers or policies from school principals so that learning can run on target and achieve goals (Ngazizah et al., 2021). One of the methods that can be used is inquiry-based learning. (Özer & Sarıbaş, 2023) Their research on developing instruments to detect science misconceptions in elementary school teachers, emphasized the importance of the inquiry approach in building correct concept understanding. They found that teachers who have a strong concept understanding tend to use the inquiry approach in their learning, which in turn helps students build a more accurate understanding (H. E. Putri et al., 2021).

In the context of learning about the meaning of magnets, the inquiry approach can be applied through simple experiments where students test different types of metals with magnets. Students can hypothesize about which metals will be attracted by a magnet, and then test the hypothesis through a hands-on experiment. Through this process, students can discover for themselves that not all metals are magnetic, helping them to correct existing misconceptions (Deke et al., 2022).

Misconceptions on the Concept of Magnetic Poles

Misconceptions on the concept of "magnetic poles" are quite high, with a total of 16.5%. Many students still think that magnetic poles can be separated. Every magnet always has two poles that cannot be separated (H. E. Putri et al., 2021). This misconception may arise due to the lack of direct experience of students in observing the notion of magnetism.

To address this misconception, the use of physical models and demonstrations can be an effective strategy. Teachers can use bar magnets that can be cut to demonstrate that each piece of magnet still has two poles. In addition, the use of visual analogies, such as comparing a magnet to a tree trunk that always has an end and a base, can help students understand the concept of inseparable magnetic poles (Ishii et al., 2021).

Misconceptions on the Concept of Magnetic and Non-magnetic Objects

On the concept of "magnetic and non-magnetic objects", a total of 14.3% had misconceptions. Some students still have difficulty distinguishing objects that cannot and can be attracted by magnets. These misconceptions may be caused by excessive generalization from students' daily observations (Nurfiyani et al., 2020).

To address this issue, a hands-on experimental approach can be highly effective. Students can be provided with various objects made from different materials and tasked with testing their magnetic properties. This hands-on experience will help them develop a more accurate understanding of the characteristics of magnetic and non-magnetic objects (Ishii et al., 2021). Additionally, using appropriate images as examples of both types of objects can further enhance their learning. This approach not only fosters a better understanding but also helps develop students' fine motor skills. Ultimately, these activities can lead to a newfound understanding of magnetic properties (D. K. Putri et al., 2024).

Misconceptions on the Application of Magnets in Everyday Life

In the sub-concept of the "application of magnets in everyday life," 13.5% of students hold misconceptions. Many students struggle to recognize how magnets are used in common devices, such as speakers and earphones. This suggests that there is a need for greater emphasis on providing relevant examples of magnet applications that relate to students' daily experiences (Didik et al., 2020). (H. E. Putri et al., 2021) in their research on improving the spatial ability of elementary school students through learning geometry using the Super Mario game, emphasized the importance of contextualizing learning. They found that when abstract concepts were linked to students' concrete experiences, understanding and retention of knowledge improved significantly.

In the context of learning about magnet applications, teachers can adopt a contextual learning approach. For example, students can be asked to identify and discuss the use of magnets in various appliances in their homes or schools. Activities such as “magnet hunting” in the surrounding environment can help students connect the concept of magnets with their daily experiences (Didik et al., 2020).

CONCLUSION

This study examines the misconceptions held by sixth-grade students at SD Muhammadiyah Purworejo regarding magnetism, utilizing the “*Certainty of Response Index*” (CRI) approach. The diagnostic test revealed that students faced several misconceptions in various sub-concepts related to magnets, including "understanding magnets," "how to make magnets," "applications of magnets in everyday life," "magnetic poles," "magnetic fields," and "distinguishing between magnetic and non-magnetic objects." The most prevalent misconception occurred in the sub-concept of "how to make a magnet," where many students believed that magnets could only be created by rubbing. This issue aligns with findings from previous studies that indicate similar misconceptions arise among students. The CRI approach encourages students to develop a more accurate and comprehensive understanding of magnetic concepts, which can help reduce these misconceptions. This research significantly contributes to understanding and addressing misconceptions in science education at the elementary school level, particularly in the area of magnetism.

REFERENCES

Abdusselam, M. S., & Karal, H. (2020). The effect of using augmented reality and sensing technology to teach magnetism in high school physics. *Technology, Pedagogy and Education*, *29*(4), 407–424. https://doi.org/10.1080/1475939X.2020.1766550

Anam, R., & Fadilah, N. (2021). Pemanfaatan CRI dalam Identifikasi Miskonsepsi Siswa pada Materi IPA. *Jurnal Pendidikan Sains*, 9(3), 55–63. https://doi.org/10.23960/jps.v9i3.55-63

Danial, M., Yunus, M., Syamsir, M., & Rahmania. (2021). A Development of IPA (Natural Sciences) Learning Tools Based on Investigative Approach in Empowering Students' Higher-Order Thinking Skills and Concept Mastery in Junior High School. *Journal of Physics: Conference Series*, *1899*(1). https://doi.org/10.1088/1742-6596/1899/1/012143

Deke, O., Astria, A., Jewaru, L., & Kaleka, Y. U. (2022). Engineering Design Process pada STEM melalui Authentic PBL dan Asesmen Formatif : Meninjau Desain Argumentasi Ilmiah Siswa Terkait Termodinamika. *Borneo Journal of Science and Mathematics Education BJSME: Borneo Journal of Science and Mathematics Education*, *2*(3), 2022. https://doi.org/10.21093/bjsme.v2i3.5948

Didik, L. A., Wahyudi, M., & Kafrawi, M. (2020). Identifikasi Miskonsepsi dan Tingkat Pemahaman Mahasiswa Tadris Fisika pada Materi Listrik Dinamis Menggunakan 3-Tier Diagnostic Test. *Journal of Natural Science and Integration*, *3*(2), 128. https://doi.org/10.24014/jnsi.v3i2.9911

Eren, E. (2021). European Journal of Educational Research. *European Journal of Educational Research*, *10*(3), 1199–1213. https://doi.org/10.12973/eu-jer.10.1.227

Faizin, A., Ngazizah, N., & Anjarini, T. (2022). Efforts to Improve Students' Gender Equality Attitude through Social Inclusion Gender Learning in Grade V Elementary School. In *Sainteknol* (Vol. 20, Issue 1). https://doi.org/10.15294/sainteknol.v20i1.37564

Fantiani, C., Afgani, M. W., & Astuti, R. T. (2023). Analisis Miskonsepsi Siswa Berbantuan *Certainty of Response Index* (CRI) pada Materi Pembelajaran Laju dan Orde reaksi. *Jurnal Inovasi Pendidikan Kimia*, *17*(1), 36–40. https://doi.org/10.15294/jipk.v17i1.34946

Fauziah, R., Hadiyanto, H., Miaz, Y., & Fitria, Y. (2021). Pengaruh Model Sains Teknologi Masyarakat terhadap Aktivitas Dan Hasil Belajar Siswa di Sekolah Dasar. *Jurnal Basicedu*, *5*(5), 3203–3215. https://doi.org/10.31004/basicedu.v5i5.1315

Halim, A. S., Finkenstaedt-Quinn, S. A., Olsen, L. J., Gere, A. R., & Shultz, G. V. (2018). Identifying and remediating student misconceptions in introductory biology via writing-to-learn assignments and peer review. *CBE Life Sciences Education*, *17*(2), 1–12. https://doi.org/10.1187/cbe.17-10-0212

Ishii, K., Tanemura, M., Okiharu, F., Onishi, H., & Takahashi, N. (2021). Simple and Beautiful Experiments XII by LADYCATS and the Science Teachers Group: In memory of Hiroshi Kawakatsu. *Journal of Physics: Conference Series*, *1929*(1), 012069. https://doi.org/10.1088/1742-6596/1929/1/012069

Kasanah, N., & Setiyawati, E. (2024). Miskonsepsi Siswa dalam Menyelesaikan Soal IPA Menggunakan *Certainty of Response Index* di SD Negeri. *Jurnal Pendidikan Guru Sekolah Dasar*, *1*(4), 1–14. https://doi.org/10.47134/pgsd.v1i4.712

Laksana, D. N. L. (2016). Miskonsepsi Dalam Materi Ipa Sekolah Dasar. *JPI (Jurnal Pendidikan Indonesia)*, *5*(2), 166. https://doi.org/10.23887/jpi-undiksha.v5i2.8588

Latif, F. H., Mursalin, Buhungo, T. J., & Odja, A. H. (2021). Analysis of Students' Misconceptions Using the *Certainty of Response Index* (CRI) on the Concept of Work and Energy in SMA Negeri 1 Gorontalo Utara After Online Learning. *Proceedings of the 7th International Conference on Research, Implementation, and Education of Mathematics and Sciences (ICRIEMS 2020)*, *528*(Icriems 2020), 511–515. https://doi.org/10.2991/assehr.k.210305.075

Maryani, W. I., & Atmojo, I. R. W. (2024). Misconceptions of science learning on force and motion material for elementary school. *Jurnal Ilmiah Pendidikan Dasar*, *11*(2), 219. https://doi.org/10.30659/pendas.11.2.219-231

Nasrudin, H., & Azizah, U. (2020). Overcoming misconception in energetic topics through implementation of metacognitive skills-based instructional materials: A case study in student of chemistry department, universitas Negeri Surabaya. *Jurnal Pendidikan IPA Indonesia*, *9*(1), 125–134. https://doi.org/10.15294/jpii.v9i1.21630

Ngazizah, N., Pratiwi, U., Fatmaryanti, S. D., Fakhrina, A., Fadjar, R., & Linda, C. (2021). The Principal's Role as Manager and Teacher Pedagogic Competence in Online Learning. *Jurnal Ilmiah Sekolah Dasar*, *5*(4), 648–657. http://dx.doi.org/10.23887/jisd.v5i4.37885

Nurfiyani, Y., Putra, M. J. A., & Hermita, N. (2020). Analisis Miskonsepsi Siswa SD Kelas V Pada Konsep Sifat-sifat Cahaya. *Journal of Natural Science and Integration*, *3*(1), 77. https://doi.org/10.24014/jnsi.v3i1.9303

Özer, F., & Sarıbaş, D. (2023). Exploring Pre-service Science Teachers' Understanding of Scientific Inquiry and Scientific Practices Through a Laboratory Course. In *Science and Education* (Vol. 32, Issue 3). Springer Netherlands. https://doi.org/10.24014/jnsi.v3i1.9303

Potvin, P. (2023). Response of science learners to contradicting information: a review of research. *Studies in Science Education*, *59*(1), 67–108. https://doi.org/10.1080/03057267.2021.2004006

Putri, D. K., Zainovi, P. S., Hanip, S. A. A., Wiryanto, W., & Julianto, J. (2024). Building 21st-century skills through the recent behavioral learning for students outcome. *Jurnal Ilmiah Pendidikan Dasar*, *11*(2), 284. https://doi.org/10.30659/pendas.11.2.284-298

Putri, H. E., Suwangsih, E., Rahayu, P., Afita, L. A. N., Dewi, N. K. Y. A., & Yuliyanto, A. (2021). Improvement of Elementary School Students 'Self-Confidence During the Covid-19 Pandemic Through the Concrete-Pictorial-Abstract (Cpa) Approach in Online Learning. *Jurnal Pajar (Pendidikan Dan Pengajaran)*, *5*(2). https://doi.org/10.33578/pjr.v5i2.8193

Rahma, C. M., Nasir, M., & Bahri, S. (2018). Jurnal Phi Identifikasi Miskonsepsi Menggunakan *Certainty of Response Index* (CRI) pada Materi. *Jurnal Pendidikan Fisika Dan Fisika Terapan*, *1*(2), 5–10. http://dx.doi.org/10.22373/p-jpft.v3i2.7457

Shofiyah, N. (2021). A Misconception Investigation of Ninth Grade Students about Magnetism. *Pedagogia : Jurnal Pendidikan*, *10*(2), 79–88. https://doi.org/10.21070/pedagogia.v10i2.781

Suprapto, N. (2020). Do We Experience Misconceptions?: An Ontological Review of Misconceptions in Science. *Studies in Philosophy of Science and Education*, *1*(2), https://doi.org/10.46627/sipose.v1i2.24

Ukoh, E. E. (2022). Teaching electromagnetism using interactive-invention instructional strategy and the learning outcome of secondary school students. *Momentum: Physics Education Journal*, *6*(1), 10–18. https://doi.org/10.21067/mpej.v6i1.5463

Widodo, A., & Wahyudin, D. (2020). Penerapan Metode CRI dalam Mengidentifikasi Miskonsepsi Siswa pada Materi Fisika. *Jurnal Pendidikan Fisika Indonesia*, 16(1), 37–45. https://doi.org/10.15294/jpfi.v16i1.20145

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