

## Misconceptions in Elementary School IPAS Learning: A Systematic Literature Review of Forms, Causes, and Remediation Strategies

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### ABSTRACT

Misconceptions in Integrated Natural and Social Sciences (IPAS) learning remain a significant challenge to elementary school students' conceptual understanding. Previous studies have primarily examined misconceptions in specific topics or developed diagnostic instruments, while comprehensive evidence synthesizing their characteristics, causes, diagnostic approaches, and instructional interventions remains limited. This study aimed to systematically synthesize empirical evidence on misconceptions in elementary IPAS learning. A Systematic Literature Review (SLR) was conducted following the PRISMA 2020 guidelines. The literature search was conducted on June 15-20, 2026, using Google Scholar through Publish or Perish. The search used the Boolean string ("*misconception*" OR "*misconceptions*") AND ("*IPAS*" OR "*integrated science*") AND ("*elementary school*" OR "*primary school*"). Eligible studies were peer-reviewed journal articles published between 2021 and 2026, written in Indonesian or English, available in full text, and focused on misconceptions in elementary IPAS or science learning. Fourteen studies met the inclusion criteria and were synthesized using thematic synthesis. The findings identified five major themes: characteristics of misconceptions, contributing factors, diagnostic instruments, intervention strategies, and evidence of intervention effectiveness. Misconceptions were primarily associated with inaccurate prior knowledge, learning resources, and instructional practices. Four-tier diagnostic tests were the most frequently used assessment tools, while conceptual change, inquiry-based learning, and instructional media were the most recommended interventions. This review provides evidence-based recommendations for identifying and addressing misconceptions and offers practical guidance for improving conceptual understanding in elementary IPAS learning.

**Keywords:** *elementary education, IPAS, misconceptions, PRISMA, systematic literature review*

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### INTRODUCTION



Integrated Natural and Social Sciences (IPAS) learning is one of the innovations introduced through the implementation of the Merdeka Curriculum at the elementary school level. It integrates concepts from natural sciences and social sciences into contextual learning experiences. This integration is intended to enable students not only to understand scientific concepts but also to relate them to social and environmental phenomena encountered in everyday life. IPAS learning is expected to develop critical thinking, problem-solving abilities, scientific literacy, social literacy, and evidence-based decision making. Putri et al. (2025) stated that IPAS learning is designed to develop critical thinking through the examination of relationships among humans, the environment, and social life. Suryani et al. (2016) further explained that IPAS learning is oriented toward contextual learning experiences that allow students to connect scientific concepts with real-world problems. Agustina et al. (2024) also emphasized that integrating natural and social sciences in IPAS learning aims to develop literacy, character, and environmental awareness.

Despite these strategic aims, the implementation of IPAS learning still faces several challenges, one of which is the occurrence of misconceptions among students. A misconception is an understanding that differs from scientifically accepted concepts and is nevertheless believed to be correct by students, thereby potentially hindering the construction of new knowledge. Qatrunnada et al. (2025), Rachmawati et al. (2025), and Munfaida et al. (2022) explained that misconceptions may arise from inaccurate prior knowledge, limited learning experiences, or instructional strategies that do not adequately support comprehensive conceptual understanding. If they are not promptly identified and corrected, misconceptions may persist for a long period and affect students' learning success at subsequent levels of education.

This phenomenon is consistent with Conceptual Change Theory proposed by Posner, Strike, Hewson, and Gertzog (1982), which explains that conceptual change occurs when students become dissatisfied with their initial conceptions and encounter a new conception that is more logical, intelligible, and useful. Driver et al. (1994) also emphasized that effective science learning is not merely the transfer of information, but a process that helps students reconstruct prior knowledge through meaningful learning experiences. Therefore, identifying misconceptions is a critical initial step before teachers determine appropriate instructional strategies.

Research conducted both in Indonesia and internationally has shown that misconceptions are consistently found in science learning. Duit and Treagust (2003) stated that misconceptions occur in almost all fundamental science concepts and often persist even after students have received formal instruction. Vosniadou (2009) explained that misconceptions develop through mental models shaped by everyday experiences, language, and instructional processes. In the context of IPAS learning in Indonesia, previous studies have identified misconceptions in topics such as ecosystems, the respiratory system, energy, force, light, changes in states of matter, biodiversity, and optics. In addition to students' prior knowledge, misconceptions have also been associated with insufficiently contextual teaching methods, limited instructional media, and conceptual inaccuracies in learning materials. Various diagnostic instruments, including two-tier, three-tier, and four-tier diagnostic tests, have been developed to identify the form and level of students' misconceptions.

Although the number of studies on misconceptions continues to increase, the available findings remain fragmented. Most studies focus on a particular topic, develop a diagnostic instrument, or evaluate the effectiveness of a specific learning model. These studies have not yet provided a comprehensive synthesis of the relationships among misconception characteristics, contributing factors, diagnostic instruments, intervention strategies, and the effectiveness of remediation in elementary IPAS learning. In addition, Systematic Literature Review (SLR) studies on misconceptions in IPAS learning remain limited. Available reviews generally employ narrative review approaches, do not follow PRISMA 2020 guidance, and do not conduct quality appraisal of the analyzed articles. This condition indicates a research gap, namely the limited availability of evidence-based syntheses that systematically and comprehensively integrate research findings on IPAS misconceptions. [Table 1](#) shows that previous studies have made

important contributions to identifying misconception forms, developing diagnostic instruments, and evaluating instructional strategies for particular topics.

**Table 1. State of the art and research gap**

| Study                       | Research Focus                                                    | Study Limitation                                                                                                | Contribution of the Present Study                                                                                                         |
|-----------------------------|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Duit & Treagust (2003)      | Characteristics and causes of misconceptions in science learning. | Conceptual in nature and does not address elementary IPAS learning.                                             | Synthesizes empirical evidence on misconceptions in elementary IPAS learning.                                                             |
| Wulandari et al. (2022)     | Misconceptions in elementary science learning.                    | Focuses on a single empirical study and therefore does not reveal broader patterns across studies.              | Identifies patterns in misconception forms and contributing factors across multiple studies.                                              |
| Prasetyo & Kurniawan (2023) | Identification of misconceptions using tiered diagnostic tests.   | Limited to one instrument and one learning topic.                                                               | Compares diagnostic instruments used across studies, including Two-Tier, Three-Tier, Four-Tier, and TTMC.                                 |
| Amelia & Fitria (2024)      | Analysis of misconceptions in a specific IPAS topic.              | Does not comprehensively integrate misconception forms, causes, interventions, and instructional effectiveness. | Presents a thematic synthesis connecting misconception forms, causes, diagnostic instruments, intervention strategies, and effectiveness. |

However, most studies remain partial and do not provide an integrated account of the relationships among misconception characteristics, contributing factors, diagnostic instruments, intervention strategies, and remediation effectiveness in elementary IPAS learning. In addition, Systematic Literature Reviews following PRISMA 2020, applying quality appraisal, and presenting comprehensive thematic synthesis remain limited. Accordingly, this study addresses this gap through an evidence-based synthesis that not only maps previous findings but also develops a conceptual model for addressing misconceptions as a basis for recommendations for elementary IPAS teaching practice.

Based on this gap, the study offers several contributions. First, it uses a Systematic Literature Review approach based on PRISMA 2020 so that article identification, selection, evaluation, and synthesis are conducted systematically and transparently. Second, it not only maps misconception forms but also integrates contributing factors, diagnostic instruments, intervention strategies, and evidence of instructional effectiveness into a single thematic synthesis. Third, the findings are expected to provide a basis for recommendations to elementary school teachers in selecting more appropriate instructional strategies to minimize misconceptions in IPAS learning.

Accordingly, this study aimed to: (1) identify the characteristics of misconceptions in elementary IPAS learning; (2) analyze factors contributing to misconceptions; (3) synthesize diagnostic instruments and intervention strategies used to identify and address misconceptions; and (4) evaluate the effectiveness of these interventions based on previous studies. The study is expected to contribute theoretically to the development of research on misconceptions in IPAS learning and practically by providing recommendations for teachers in designing more effective instruction.

## METHODS

### Research Design

This study used a Systematic Literature Review (SLR) method following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines ([Page et al., 2021](#)). The SLR approach was selected because it enables research findings to be identified, evaluated, and synthesized systematically, transparently, and replicably, thereby producing an evidence-based synthesis of misconceptions in elementary Integrated Natural and Social Sciences (IPAS) learning.

The review was designed to answer four research questions:

- (1) What are the characteristics of misconceptions in elementary IPAS learning?
- (2) What factors contribute to the occurrence of misconceptions?
- (3) What strategies or instruments are used to identify and address misconceptions? And
- (4) How effective are these strategies according to previous studies?

### Literature Search Strategy

The literature search was conducted on June 15-20, 2026, using Publish or Perish (PoP) version 8 connected to the Google Scholar database. PoP was used to retrieve article metadata systematically, while article selection followed the PRISMA 2020 guidelines.

The search strategy used the following combination of keywords and Boolean operators: (*"Misconception" OR "Misconceptions"*) AND (*"IPAS" OR "Integrated Science"*) AND (*"Elementary School" OR "Primary School"*)

The search was limited using the following filters: journal articles, publication years 2021-2026, full text available, written in Indonesian or English, and relevance to elementary education. The initial identification stage yielded 460 articles.

### Inclusion and Exclusion Criteria

Articles were selected based on the inclusion and exclusion criteria as presented in [Table 2](#).

**Table 2. Inclusion and exclusion criteria**

| Inclusion Criteria                                           | Exclusion Criteria                                                                            |
|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Published between 2021 and 2026                              | Published before 2021                                                                         |
| Addresses misconceptions in elementary IPAS/science learning | Does not address misconceptions                                                               |
| Empirical research                                           | Review article, conference proceeding, undergraduate thesis, master's thesis, or dissertation |
| Full text available                                          | Full text unavailable                                                                         |
| Elementary school level                                      | Educational level other than elementary school                                                |
| Reports research data                                        | Conceptual or opinion article                                                                 |

### Article Selection Process

Article selection followed the PRISMA 2020 stages of identification, screening, eligibility, and inclusion. The identification stage yielded 460 articles. Deduplication removed 18 records with identical metadata, leaving 442 articles for title and abstract screening. At this stage, 392 articles were excluded because they did not align with the focus of the review.

Fifty articles that passed screening were then evaluated through full-text assessment. Based on this process, 36 articles were excluded because they did not meet the study criteria: 9 did not address misconceptions in elementary IPAS, 11 were conducted at educational levels other than elementary school, 8 did not report empirical data, 4 were review articles, and 4 were not available in full text. Consequently, 14 articles met all inclusion criteria and were included in the synthesis.

To improve the reliability of the selection process, screening was conducted by two independent assessors. The first assessor performed identification, selection, and data extraction, while the second assessor rechecked the articles that passed selection. Differences in selection decisions were resolved through discussion until agreement was reached. [Figure 1](#) illustrates the article selection process based on the PRISMA 2020 guidelines.

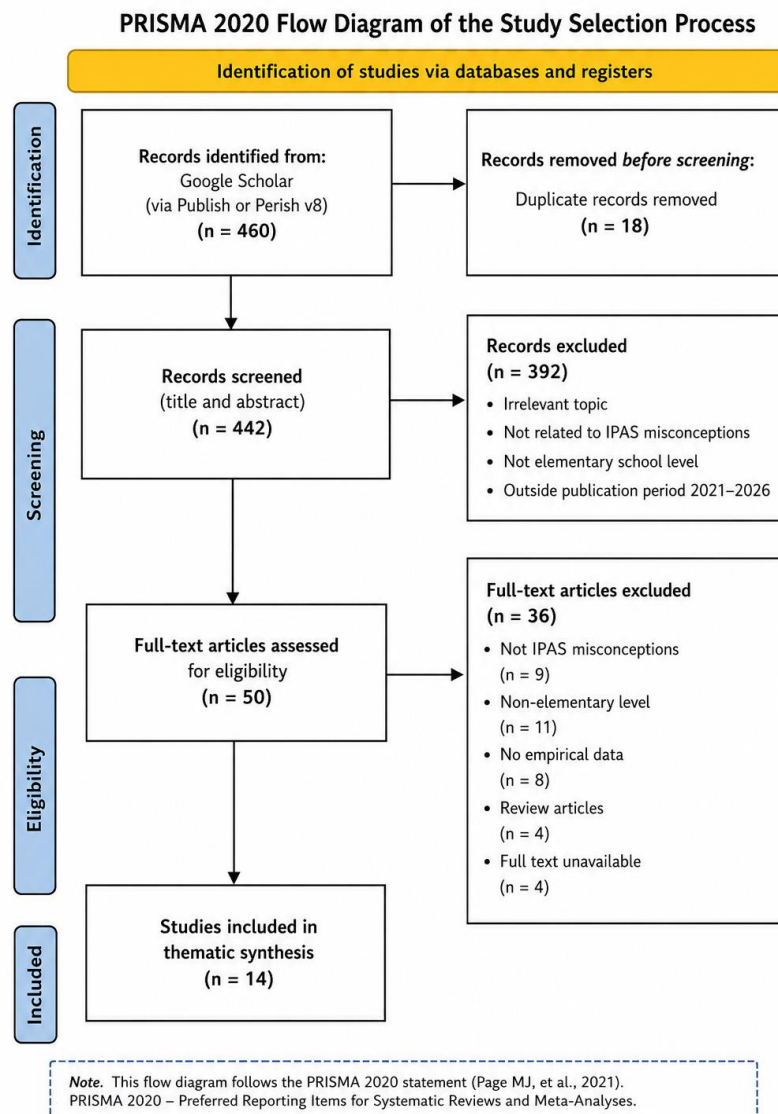


**Figure 1. PRISMA 2020 Flow Diagram of Article Selection**

Of 460 articles identified through Google Scholar using Publish or Perish, 18 were removed during deduplication. The remaining 442 articles were screened by title and abstract, and 392 were excluded as irrelevant to the review focus. Fifty articles then underwent full-text eligibility assessment. After applying the inclusion and exclusion criteria, 36 articles were excluded, leaving 14 articles for thematic synthesis.

### Quality Appraisal

All articles meeting the inclusion criteria were assessed for methodological quality using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist modified for educational research. The appraisal examined eight aspects: (1) clarity of research objectives, (2) appropriateness of the research design, (3) sample characteristics, (4) instrument validity, (5) data analysis techniques, (6) clarity of research findings, (7) appropriateness of conclusions, and (8) relevance to the review focus. Each indicator received a score of 1 when the criterion was met and 0 when it was not. Total scores were classified as high quality (7-8), moderate quality (5-6), or low quality (4 or lower). Only studies of moderate or high quality were included in the synthesis to strengthen confidence in the review findings.

### Data Extraction

Data were extracted using an extraction sheet developed according to the study objectives. The extracted information included author, publication year, country or research context, grade level, research design, sample size, IPAS topic, diagnostic instrument, form of misconception, contributing factors, remediation strategy, and major findings.

### Study Characteristics

[Table 3](#) shows the characteristics of the 14 analyzed articles. Most studies used quantitative descriptive designs and focused on Grade IV and Grade V elementary school students. The sample sizes generally ranged from 15 to 39 students, although some studies did not report the sample size. The most common instruments were tiered diagnostic tests, including two-tier, three-tier, and four-tier tests. Other studies used questionnaires, concept tests, observation, documentation, and content analysis. The topics covered included ecosystems, the respiratory system, light, states of matter, force, energy, biodiversity, concave mirrors, instructional media, and IPAS textbooks. Several studies also used document analysis to examine IPAS textbooks rather than collecting data directly from students.

**Table 3. Characteristics of the analyzed articles**

| No. | Author (Year)                          | Context/Grade                         | Design                   | Sample                       | Instrument                      | Topic               |
|-----|----------------------------------------|---------------------------------------|--------------------------|------------------------------|---------------------------------|---------------------|
| 1   | Mahmudah & Fakhriyah (2026)            | Grade V elementary school             | Quantitative descriptive | 15 Grade V students          | Four-Tier Diagnostic Test       | Ecosystems          |
| 2   | Kurnianto & Fakhriyah (2026)           | Grade IV elementary school            | Quantitative descriptive | 15 Grade IV students         | Four-Tier Diagnostic Test       | IPAS                |
| 3   | Achsa & Fakhriyah (2025)               | Grade V elementary school             | Quantitative descriptive | 15 Grade V students          | Three-Tier Diagnostic Test      | Respiratory system  |
| 4   | Yantaviyani, Lestari, & Wardani (2026) | Grade V elementary school             | Quantitative descriptive | 39 Grade V students          | Two-Tier Multiple Choice        | Light               |
| 5   | Ashofa, Rahayu, & Hasanah (2025)       | Grade IV elementary school            | Quantitative descriptive | Grade IV elementary students | Two-Tier Multiple Choice (TTMC) | States of matter    |
| 6   | Simatupang, Tambunan, & Siregar (2025) | Elementary school                     | Quantitative descriptive | Not reported                 | Two-Tier Diagnostic Test        | Science/IPAS        |
| 7   | Luthfia, Rahma, & Kusuma (2026)        | Elementary IPAS textbook analysis     | Document analysis        | IPAS textbook                | Content analysis                | Biodiversity        |
| 8   | Lestari (2025)                         | Elementary school teachers            | Qualitative descriptive  | IPAS instructional media     | Observation and documentation   | Instructional media |
| 9   | Rahmadhani & Rohmah (2025)             | IPAS textbook analysis                | Document analysis        | IPAS textbook                | Content analysis                | IPAS textbook       |
| 10  | Arif & Fatimah (2025)                  | Elementary Teacher Education students | Descriptive              | IPAS textbook                | Questionnaire                   | Concave mirrors     |

| No. | Author (Year)                          | Context/Grade              | Design                   | Sample               | Instrument             | Topic         |
|-----|----------------------------------------|----------------------------|--------------------------|----------------------|------------------------|---------------|
| 11  | Raysalma, Handayani, & Nugroho (2025)  | Grade IV elementary school | Quantitative descriptive | 39 Grade V students  | Tiered diagnostic test | Force         |
| 12  | Hidayatullah, Setiawan, & Utami (2025) | Grade V elementary school  | Quantitative descriptive | Not reported         | Diagnostic test        | Energy        |
| 13  | Rahmawati & Kurniawati (2024)          | Elementary school          | Quantitative descriptive | 39 Grade IV students | Concept test           | IPAS          |
| 14  | Budiarti (2023)                        | IPAS textbook analysis     | Document analysis        | 1 textbook           | Content analysis       | IPAS textbook |

[Table 4](#) shows that all 14 articles clearly reported their objectives, research designs, samples, instruments, analysis procedures, and conclusions.

**Table 4. Results of article quality appraisal**

| No. | Author (Year)                | Objective | Design | Sample | Instrument | Analysis | Conclusion | Score | Category |
|-----|------------------------------|-----------|--------|--------|------------|----------|------------|-------|----------|
| 1   | Mahmudah & Fakhriyah (2026)  | ✓         | ✓      | ✓      | ✓          | ✓        | ✓          | 8     | High     |
| 2   | Kurnianto & Fakhriyah (2026) | ✓         | ✓      | ✓      | ✓          | ✓        | ✓          | 8     | High     |
| 3   | Achsa & Fakhriyah (2025)     | ✓         | ✓      | ✓      | ✓          | ✓        | ✓          | 7     | High     |
| 4   | Yantaviyani et al. (2026)    | ✓         | ✓      | ✓      | ✓          | ✓        | ✓          | 7     | High     |
| 5   | Ashofa et al. (2025)         | ✓         | ✓      | ✓      | ✓          | ✓        | ✓          | 7     | High     |
| 6   | Simatupang et al. (2025)     | ✓         | ✓      | ✓      | ✓          | ✓        | ✓          | 7     | High     |
| 7   | Luthfia et al. (2026)        | ✓         | ✓      | ✓      | ✓          | ✓        | ✓          | 6     | Moderate |
| 8   | Lestari (2025)               | ✓         | ✓      | ✓      | ✓          | ✓        | ✓          | 6     | Moderate |
| 9   | Rahmadhani & Rohmah (2025)   | ✓         | ✓      | ✓      | ✓          | ✓        | ✓          | 6     | Moderate |
| 10  | Arif & Fatimah (2025)        | ✓         | ✓      | ✓      | ✓          | ✓        | ✓          | 6     | Moderate |
| 11  | Raysalma et al. (2025)       | ✓         | ✓      | ✓      | ✓          | ✓        | ✓          | 7     | High     |
| 12  | Hidayatullah et al. (2025)   | ✓         | ✓      | ✓      | ✓          | ✓        | ✓          | 7     | High     |

| No. | Author (Year)                 | Objective | Design | Sample | Instrument | Analysis | Conclusion | Score | Category |
|-----|-------------------------------|-----------|--------|--------|------------|----------|------------|-------|----------|
| 13  | Rahmawati & Kurniawati (2024) | ✓         | ✓      | ✓      | ✓          | ✓        | ✓          | 6     | Moderate |
| 14  | Budiarti (2023)               | ✓         | ✓      | ✓      | ✓          | ✓        | ✓          | 6     | Moderate |

Eight articles (57.14%) were classified as high quality, while six articles (42.86%) were classified as moderate quality. No article was classified as low quality. Therefore, all included articles were considered appropriate for further analysis. In the synthesis, high-quality studies were used as the primary sources for deriving research themes, while moderate-quality studies were used to support interpretation and compare findings across studies.

### Data Synthesis Technique

Data were synthesized using thematic synthesis. Research findings were grouped into five main themes: (1) characteristics of misconceptions, (2) forms of misconceptions, (3) contributing factors, (4) diagnostic instruments, and (5) remediation strategies. Comparative analysis across studies was then conducted to identify consistent patterns and differences, resulting in an evidence-based synthesis of misconceptions in elementary IPAS learning.

## RESULTS AND DISCUSSION

### Characteristics of the Analyzed Studies

Based on the PRISMA 2020 selection process, 14 articles met all inclusion criteria and were analyzed in depth. The study characteristics show that the articles were published within the 2021-2026 period, indicating growing research attention to misconceptions in elementary IPAS learning.

By research design, 8 articles (57.14%) used quantitative descriptive approaches, 3 articles (21.43%) used document analysis, 1 article (7.14%) used a qualitative descriptive approach, and 2 articles (14.29%) used other descriptive designs. Most studies involved elementary school students as participants, while several studies analyzed IPAS textbooks as potential sources of misconceptions.

The most frequently used instrument was the Four-Tier Diagnostic Test, followed by the Two-Tier Diagnostic Test, Three-Tier Diagnostic Test, Two-Tier Multiple Choice (TTMC), textbook content analysis, observation, and conventional diagnostic tests. Based on the quality appraisal, all articles were of moderate to high methodological quality and were therefore considered suitable for thematic synthesis.

### Forms of Misconceptions in IPAS Learning

The synthesis of the 14 articles indicates that misconceptions in elementary IPAS learning can be grouped into four main forms: misunderstanding of concepts, incorrect relationships among concepts, misinterpretation of scientific phenomena, and misunderstanding of illustrations or visual representations (see [Table 5](#)).

**Table 5. Forms of misconceptions identified**

| Form of Misconception                     | Number of Articles |
|-------------------------------------------|--------------------|
| Conceptual errors                         | 12                 |
| Incorrect relationships among concepts    | 9                  |
| Misinterpretation of phenomena            | 8                  |
| Misinterpretation of images/illustrations | 5                  |

Conceptual errors were the most frequently identified form of misconception. These misconceptions occurred across IPAS topics including ecosystems, the respiratory system, energy, force, light, and changes in states of matter. Students generally entered instruction with prior knowledge that did not align with scientific concepts, which made it difficult for them to correctly integrate new information. This finding supports Conceptual Change Theory, which proposes that students tend to maintain their initial conceptions until they encounter learning experiences that create cognitive conflict and encourage conceptual restructuring (Posner et al., 1982).

### Factors Contributing to Misconceptions

The synthesis shows that misconceptions originate not only from students but are also influenced by teachers, textbooks, instructional media, and the learning process (see [Table 6](#)).

**Table 6. Factors contributing to misconceptions**

| Contributing Factor                 | Number of Articles |
|-------------------------------------|--------------------|
| Students' prior knowledge           | 11                 |
| Textbooks                           | 5                  |
| Instructional media                 | 4                  |
| Teachers' instructional strategies  | 6                  |
| Scientific language and terminology | 3                  |

Students' prior knowledge was the most dominant factor. Most studies reported that students had developed understandings from everyday experiences, causing scientific concepts to be interpreted inaccurately. Several studies also found that illustrations in IPAS textbooks and inappropriate use of instructional media could reinforce misconceptions. These findings show that misconceptions are multidimensional phenomena shaped by interactions among learner characteristics, the quality of learning resources, and teachers' instructional strategies.

### Diagnostic Instruments for Identifying Misconceptions

The reviewed studies used various instruments to identify misconceptions. The Four-Tier Diagnostic Test was the most frequently used because it can distinguish students who understand a concept from those who hold misconceptions or are merely guessing (see [Table 7](#)).

**Table 7. Diagnostic instruments used**

| Instrument                      | Number of Articles |
|---------------------------------|--------------------|
| Four-Tier Diagnostic Test       | 5                  |
| Two-Tier Diagnostic Test        | 3                  |
| Three-Tier Diagnostic Test      | 2                  |
| Two-Tier Multiple Choice (TTMC) | 2                  |
| Textbook analysis               | 2                  |

The advantage of the Four-Tier Diagnostic Test lies in its ability to identify the reasoning underlying students' answers together with their confidence level. Therefore, this instrument was considered more comprehensive than conventional multiple-choice tests.

### Strategies for Addressing Misconceptions

The synthesis identified several strategies that have been used to reduce students' misconceptions (see [Table 8](#)).

**Table 8. Strategies for addressing misconceptions**

| Strategy                        | Number of Articles |
|---------------------------------|--------------------|
| Diagnostic tests                | 6                  |
| Conceptual Change               | 5                  |
| Inquiry                         | 4                  |
| Experiments                     | 3                  |
| Instructional media development | 4                  |

The Conceptual Change approach emerged as the most strongly emphasized instructional strategy because it helps students reconstruct prior knowledge through cognitive conflict. In addition, diagnostic assessment before instruction allows teachers to identify misconceptions at an early stage so that interventions can be targeted more appropriately.

### Thematic Synthesis

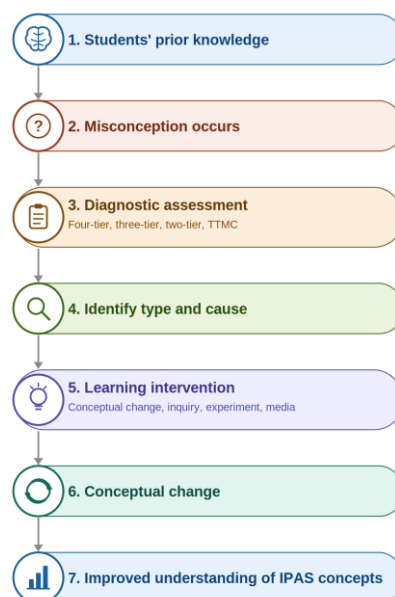
This synthesis shows that misconceptions in IPAS learning are interrelated phenomena. Inaccurate prior knowledge may develop into persistent misconceptions when it is not detected early. Therefore, the use of diagnostic assessment before instruction is an important step in designing an appropriate intervention (see [Table 9](#)).

**Table 9. Thematic Synthesis of the Reviewed Studies**

| Theme                   | Synthesis of Findings                                                                                                                 |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Forms of misconceptions | Conceptual errors were the most dominant form of misconception.                                                                       |
| Contributing factors    | Students' prior knowledge was the primary factor and was reinforced by the quality of textbooks, media, and instructional strategies. |
| Diagnostic instruments  | The Four-Tier Diagnostic Test was the most frequently used and most comprehensive instrument.                                         |
| Remediation strategies  | Conceptual Change combined with diagnostic assessment was reported as the most effective approach.                                    |

### Conceptual Model for Addressing Misconceptions

As a synthesis of the 14 included articles, this study proposes a conceptual model for addressing misconceptions in IPAS learning, as shown in [Figure 2](#).

**Figure 2. Conceptual model for addressing misconceptions in IPAS learning**

The model indicates that successful remediation of misconceptions depends on the connection among diagnostic assessment, identification of contributing factors, and selection of an appropriate instructional strategy. Teachers need not only to know that a student holds a misconception, but also to understand its form and underlying cause so that the intervention can be more effective.

### Implications for Elementary School Teachers

The synthesis shown in [Table 10](#) provides several practical implications for elementary school teachers.

**Table 10. Implications of the findings for teachers**

| <b>Finding</b>                                                        | <b>Implication</b>                                                                                                         |
|-----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Misconceptions are common in fundamental IPAS concepts.               | Teachers need to conduct diagnostic assessment before instruction.                                                         |
| Prior knowledge is the primary contributing factor.                   | Learning should begin by eliciting students' prior knowledge.                                                              |
| The Four-Tier Diagnostic Test is the most frequently used instrument. | Teachers can use tiered diagnostic instruments to identify misconceptions.                                                 |
| Textbooks can contribute to misconceptions.                           | Teachers need to verify learning materials and provide additional explanations when concepts may lead to misunderstanding. |
| Conceptual Change is reported as effective.                           | Teachers need to implement learning experiences that create cognitive conflict to support conceptual change.               |

Overall, the findings emphasize that misconceptions cannot be addressed merely by providing the correct information. Teachers need to integrate diagnostic assessment, conceptual change-oriented instructional strategies, and continuous evaluation so that students' understanding of IPAS concepts can develop in a more scientific and meaningful manner.

### CONCLUSION

This study aimed to synthesize research findings on misconceptions in elementary Integrated Natural and Social Sciences (IPAS) learning through a Systematic Literature Review following the PRISMA 2020 guidelines. The synthesis of 14 articles shows that misconceptions remain common across various IPAS topics, particularly in relation to conceptual misunderstandings, relationships among concepts, and interpretation of scientific phenomena. Contributing factors are not limited to students' prior knowledge, but also include textbook quality, instructional media, teachers' instructional strategies, and inaccurate conceptual representations. The review also shows that the Four-Tier Diagnostic Test was the most frequently used diagnostic instrument and was considered useful for distinguishing students who hold misconceptions from those who understand or do not yet understand a concept. In addition, Conceptual Change approaches supported by diagnostic assessment, inquiry-based learning, experiments, and appropriate instructional media were among the most frequently recommended strategies for helping students reconstruct scientific concepts more accurately. These findings imply that elementary school teachers need to conduct diagnostic assessment before instruction, identify the form and source of students' misconceptions, and select instructional strategies that can promote conceptual change. Addressing misconceptions should therefore focus not only on correcting students' answers but also on continuously reconstructing their conceptual understanding so that the quality of IPAS learning can be improved. This review has several limitations. First, it included only articles indexed through Google Scholar using Publish or Perish and therefore did not cover international databases such as Scopus, Web of Science, or ERIC. Second, the included articles were limited to the 2021-2026 publication period, so the findings do not represent the longer-term development of research on misconceptions. Third, most of the analyzed articles were conducted in the Indonesian educational context, and the generalizability of the findings to other countries should therefore be approached cautiously.

Future research should expand literature sources by including international databases, extend the publication period, and compare findings across countries to obtain a more comprehensive synthesis. Further studies may also examine the effectiveness of various Conceptual Change-based learning models, the use of digital technologies, and the development of Artificial Intelligence-based diagnostic instruments to improve the accuracy of identifying and addressing misconceptions in elementary IPAS learning.

### **CONFLICTS OF INTEREST**

The authors declare that there is no conflict of interest.

### **AUTHOR CONTRIBUTIONS STATEMENT**

G. contributed to the conceptualization of the study, literature search, data collection, data extraction, data synthesis, and preparation of the original manuscript. T.H.; contributed to the development of the research methodology, literature screening, data analysis, interpretation of findings, and critical revision of the manuscript. E.D.; contributed to the methodological review, interpretation of the findings, and critical evaluation of the manuscript. K.W.; contributed to the theoretical review, validation of the synthesis, and critical revision of the manuscript. B.H.C.K.; contributed to the literature review, interpretation of the findings, and critical revision of the manuscript. All authors reviewed and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

### **AI DISCLOSURE STATEMENT**

The authors used a generative artificial intelligence tool, ChatGPT, to support language refinement, improve sentence clarity, and assist with the organization of the manuscript during the preparation process. The use of the tool was limited to language and editorial support and did not replace the authors' responsibility for literature searching, study selection, data extraction, analysis, interpretation, or scholarly judgment. All AI-assisted content was thoroughly reviewed, verified, and revised by the authors. The authors take full responsibility for the accuracy, originality, and integrity of the content presented in this publication.

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