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Factors Causing Learning Difficulties in Elementary School Students' Understanding of Optical Concepts

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Abstract: Natural Science learning in elementary schools plays a crucial role in building students' scientific thinking skills. However, understanding basic optical concepts such as light, reflection, refraction, propagation, and shadow formation remains a significant challenge. This study aims to analyse the factors causing students' learning difficulties in understanding basic optical concepts through a literature review. The method employed was a review of eight scientific articles published between 2020 and 2026, sourced from Google Scholar and SINTA, using content analysis techniques. The findings show that students still experience misconceptions in optical concepts, particularly in reflection, refraction, and light dispersion. Learning difficulties are influenced by internal factors such as low prior understanding, limited abstract thinking ability, and learning motivation as well as external factors, including the dominance of lecture-based methods, insufficient learning media, limited practicum activities, and suboptimal use of diagnostic instruments. Efforts to address these difficulties can be pursued through conceptual change strategies, the Predict-Observe-Explain (POE) model, multiple representations, and the use of virtual laboratories to help students visualise abstract concepts in a more concrete and meaningful way.

Keywords: learning difficulties, misconceptions, basic optics, science learning, elementary school

Abstrak: *Pembelajaran Ilmu Pengetahuan Alam (IPA) di Sekolah Dasar memiliki peran krusial dalam membangun kemampuan berpikir ilmiah siswa. Namun, pemahaman konsep optik dasar seperti cahaya, pemantulan, pembiasan, perambatan, dan pembentukan bayangan masih menjadi tantangan. Penelitian ini bertujuan menganalisis faktor penyebab kesulitan belajar siswa dalam memahami konsep optik dasar melalui studi literatur. Metode yang digunakan adalah kajian literatur terhadap delapan artikel ilmiah terbitan tahun 2020–2026 dari Google Scholar dan Sinta dengan teknik analisis isi. Hasil penelitian menunjukkan bahwa siswa masih mengalami miskonsepsi pada konsep optik, terutama pemantulan, pembiasan, dan dispersi cahaya. Kesulitan belajar dipengaruhi oleh faktor internal, seperti rendahnya pemahaman awal, keterbatasan berpikir abstrak, dan motivasi belajar, serta faktor eksternal, seperti metode ceramah, kurangnya media pembelajaran, minimnya praktikum, dan penggunaan instrumen diagnostik yang belum optimal. Upaya mengatasi kesulitan tersebut dapat dilakukan melalui strategi conceptual change, Predict Observe Explain (POE), multiple representations, serta pemanfaatan virtual laboratory untuk membantu siswa memvisualisasikan konsep abstrak menjadi lebih konkret dan bermakna.*

Kata Kunci: *kesulitan belajar, miskonsepsi, optik dasar, pembelajaran IPA, sekolah dasar*

INTRODUCTION

Natural Science learning at the elementary school level constitutes an important foundation for developing students' scientific, logical, and critical thinking abilities. One topic taught at this level is basic optics, which encompasses concepts of light, its properties, and phenomena such as reflection and refraction. However, various reports indicate that students' understanding of basic

science concepts remains low (Fahmi et al., 2022). Results from international studies such as the Programme for International Student Assessment (PISA) show that Indonesian students' scientific literacy is still below the global average, pointing to fundamental problems in the science learning process. In line with these international data, various domestic studies confirm the low level of IPA conceptual understanding at the elementary school level. Hartanti, Mariana, and Ekawati (2024) found that elementary school students continue to experience misconceptions caused by the large number of concepts in the curriculum, the scarcity of Indonesian-language resources, and teachers who have yet to develop a deep understanding of IPA content. Similarly, As Sa'adah et al. (2025) found that 43.33% of students had a low level of IPA conceptual understanding, attributable to insufficient student interest and learning motivation. These conditions underscore the urgency of identifying the factors causing students' learning difficulties, particularly in understanding basic optical concepts at the elementary level.

Students' learning difficulties in understanding basic optical concepts are inseparable from the characteristics of the material, which demands abstract thinking ability. Elementary school students, who are still at the concrete operational stage as described by Jean Piaget's theory of cognitive development, tend to encounter obstacles in understanding phenomena that cannot be observed directly. Students frequently experience misconceptions about light concepts, such as the direction of light propagation and the process of shadow formation (Deviana & Desstya, 2024). This situation is compounded by instructional approaches still dominated by the lecture method, leaving students with insufficient concrete and meaningful learning experiences. Yet science instruction should place greater emphasis on providing authentic experiences to develop students' competency in understanding their natural environment, rather than focusing solely on theoretical memorisation (Dwilestari & Desstya, 2022; Fauzi et al., 2023).

In addition to cognitive factors, learning difficulties are also influenced by external factors such as the teaching method, teacher competency, and the availability of learning media. Monotonous teaching methods, limited variety in learning media, complex curricula, and inadequate facilities all affect students' learning processes (Nanda & Handayani, 2025; Andina et al., 2025). Currently, many teachers across various regions have yet to develop sufficient skills in using technological tools, particularly for instructional purposes (Hanif & Putra, 2024). Limitations in facilities such as teaching aids and laboratories also cause optics instruction to be delivered predominantly in a theoretical manner (Auliyak & Syahri, 2022). According to data from Kemendikbudristek in 2023, of the total 148,882 elementary schools (SD) in Indonesia, only approximately 7% possess science laboratories, of which around 64% are in good condition while the remainder have suffered minor to severe damage (Lubis & Audina, 2024). This situation can reduce students' interest in science learning, lower learning outcomes, and limit the development of students' science skills. Yet optical concepts greatly depend on demonstrations and experiments for students to understand phenomena directly, making the learning process more meaningful. These various factors collectively risk giving rise to persistent misconceptions that, if not identified and corrected early, will endure and impede students' conceptual development (Purba et al., 2026; Andina Puspita et al., 2025).

Several prior studies have examined elementary school students' misconceptions about light and its properties using various diagnostic instruments, such as the CRI, Two-Tier Multiple Choice, Five-Tier Diagnostic Test, and interview techniques (Deviana & Desstya, 2024; Adi, Widodo, & Sopandi, 2024; Riti, Sar'iyyah, & Bito, 2022). These findings consistently reveal that misconceptions about reflection, refraction, light propagation, and light sources persist among the majority of elementary school students at worrying rates. For example, Deviana and Desstya (2024) found that only 8% of students genuinely understood the concept of light, while Wulandari (2024) recorded the highest misconception rate on the sub-topic of light penetrating transparent objects, reaching 70%. Meanwhile, Nurfiyani, Putra, and Hermita (2020) reported that more than half of Grade V students held misconceptions, including the belief that stars are not light sources because their intensity is perceived as too dim. These findings generally reveal various causal factors, including the dominance of the lecture method, minimal use of concrete media and practicum

activities, low learning motivation, and weak elicitation of students' prior conceptions before instruction begins (Kurniasari & Nugroho, 2025; Yantaviyani, Handayani, & Mudzanatun, 2026).

At present, only a limited number of studies have specifically focused on the elementary school level with a systematic literature review approach to integrate the existing findings. This research gap highlights the need for a comprehensive literature study to examine the various factors causing students' learning difficulties in optical material more thoroughly. This study is therefore expected to provide a more complete picture of the problems at hand while filling the gaps left by previous research that remains limited in scope and depth of analysis.

Based on this background, this study aims to analyse the factors causing learning difficulties among elementary school students in understanding basic optical concepts through a literature review. Theoretically, this study is expected to enrich the body of knowledge in science education, particularly regarding students' learning difficulties. Practically, the findings can serve as a reference for teachers, curriculum developers, and education policy-makers in designing more effective, innovative, and student-appropriate learning strategies, thereby improving the quality of science learning in elementary schools and enhancing students' understanding of optical concepts.

METHODS

This study employed a literature review research method. A literature review is a research method focused on the collection, evaluation, and synthesis of various prior research findings to obtain an overview of previous studies and to understand the development and direction of inquiry in a given research field (Kurniati & Jailani, 2023). This review aimed to identify, analyse, and synthesise various relevant research findings related to the factors causing learning difficulties on basic optics material among elementary school students.

The data sources in this study consisted of scientific articles obtained through Google Scholar and the SINTA journal portal. These two databases were selected because they provide broad and relevant coverage of educational scientific articles aligned with the research topic. Scopus was not used because no articles meeting the established review criteria were found, and due to limited access to relevant publications. The literature search was conducted online using several keywords: "kesulitan belajar materi cahaya SD", "kesulitan belajar optik dasar siswa sekolah dasar", and "optics learning difficulties elementary students".

Articles obtained were then selected based on inclusion and exclusion criteria. The inclusion criteria were: (1) the article discusses the factors causing students' learning difficulties on basic optics or light material at the elementary school level; (2) the article was published between 2020 and 2026; (3) the article is written in Indonesian or English; (4) the full text is available; and (5) the article presents research with clear data and findings. The exclusion criteria comprised articles not relevant to the research focus, duplicate articles, articles not fully accessible, and articles consisting solely of opinion without research data.

The article selection process was carried out in several stages. In the first stage, articles were identified through Google Scholar and SINTA using the designated keywords. A selection was then made based on title and abstract to assess each article's alignment with the research focus. Articles passing this stage were subsequently subjected to a comprehensive full-text review based on the established inclusion criteria. Of all articles found, only eight met all criteria and provided the most relevant discussion of the factors causing students' learning difficulties on basic optics material at the elementary school level. These eight articles were selected because they contained complete research data, an appropriate focus of study, and consistent information on the causal factors of students' learning difficulties.

The research instrument consisted of a data recording sheet used to capture key information from each article, including the researcher's name, year of study, research objectives, research method, research findings, and the causal factors of learning difficulties identified in each study. This instrument facilitated systematic data classification and analysis.

Figure 1. Article Selection Process Flowchart

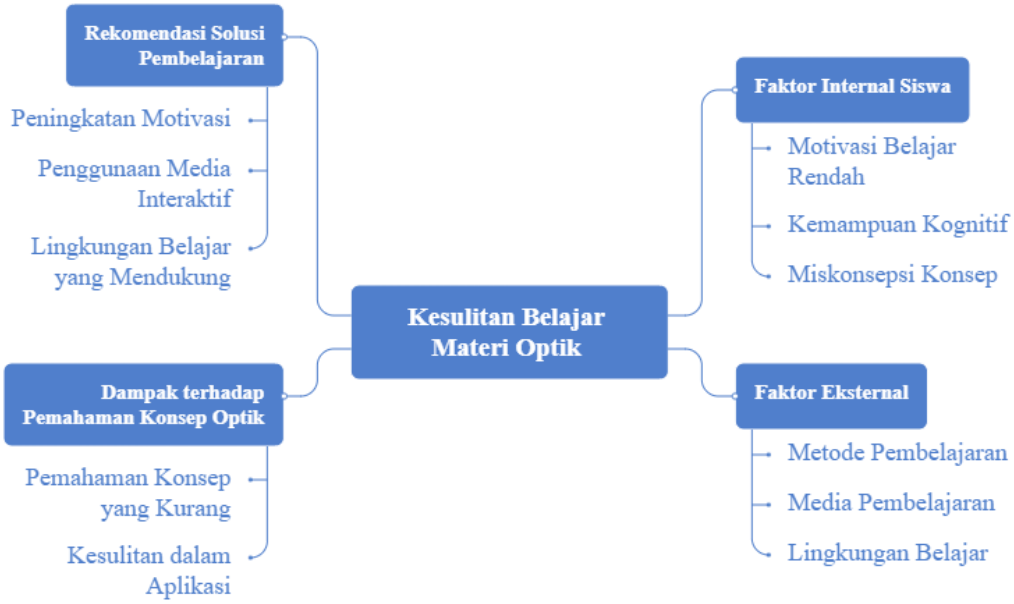

Figure 2. Conceptual Framework

The conceptual framework of this study is presented in Figure 2, which illustrates the relationships among the variables. Learning difficulties in basic optics material are influenced by two main factors: internal and external. Internal factors include learning motivation, cognitive ability, and concept misconceptions, while external factors include the teaching method, learning media, and the learning environment. Both sets of factors affect students' conceptual understanding of basic optical material and are subsequently analysed to determine the form of learning difficulties experienced by students.

The limitation of this study lies in the use of sources obtainable only through online access via Google Scholar and the SINTA portal, restricted to a specific time range, which means some relevant studies may not have been captured. Nevertheless, the findings of this review are expected to provide a more comprehensive picture of the factors causing students' learning difficulties and to serve as a reference for future research.

RESULTS AND DISCUSSION

Based on the review of eight journals published between 2022 and 2026, it is evident that instruction on basic optical material particularly light and its properties in elementary schools still faces various obstacles, primarily related to students' low conceptual understanding. Most studies show that students experience misconceptions across various sub-topics, including reflection, refraction, and light propagation.

Table 1. Summary of Research Findings on Elementary School Students' Misconceptions in Understanding Optical Concepts

No.	Author	Title	Misconceptions Found	Causes
1.	Hutasoit et al. (2025)	*Analysis of Science Learning on Light Material at SD 2 HKBP Sidorame*	Most students did not understand the properties of light and their applications in everyday life. Some believed that light is used to improve bodily health. Most also incorrectly defined rainbows.	Dominant use of the lecture method, limited teaching aids, and insufficient interactive media, making concepts of light reflection and refraction seem abstract.
2.	Yantaviyani, Handayani, & Mudzanatun (2026)	*Analysis of IPAS Misconceptions on Light and Its Properties via Two-Tier Multiple Choice (TTMC) in Grade V Elementary School*	29.66% of students held misconceptions, 26% did not understand the concepts, and only 26.66% demonstrated understanding. The highest misconception occurred on mirror properties: students believed all mirrors produce upright images and that convex mirrors can focus light like concave mirrors.	Internal factors (low motivation and self-confidence) and external factors (dominant lecture method, lack of media and practicum, and students' prior knowledge not explored).
3.	Kurniasari & Nugroho (2025)	*The Effect of the Predict-Observe-Explain Strategy on Reducing Misconceptions about Light in Elementary Schools*	Misconceptions remained high, particularly on reflection, refraction, and shadow formation. Students often assumed that shadows always appear behind an object and that light bending occurs because the object "wants" to change direction. Application of the POE strategy was proven to significantly reduce misconceptions.	Low basic conceptual understanding and use of instructional strategies that do not provide opportunities for observation and reflection.
4.	Wulandari (2024)	*Analysis of Misconceptions about Light and Its Properties in Grade IV Students of SDN 1 Nagarawangi*	The highest misconception occurred on light penetrating transparent objects (70%), reflection (43%), light concepts (43%), dispersion (25%), linear propagation (33%), and refraction (11%). Students assumed the moon is a light source because it emits light at night, and many believed all coloured plastic and glass can be penetrated by light.	Weak prior understanding, limited teaching time, and inaccurate delivery of material.

5.	Deviana & Desstya (2024)	*Analysis of Misconceptions about Light Using the Interview About Instances Technique with Elementary School Students*	Only 8% of students understood the concept, 19% held misconceptions, and 73% did not understand. The highest misconception occurred on refraction and light propagation. Students believed refraction occurs because light moves through water. They also stated that shadows form when light cannot pass through an object.	Dominant lecture method, minimal concrete media, limited direct experience, difficulty reading texts, students' faulty intuition, and absence of diagnostic testing.
6.	Nurfiyani et al. (2020)	*Analysis of Grade V Elementary School Students' Misconceptions on the Properties of Light*	53.57% of Grade V students held misconceptions (moderate level). The highest misconception was on light sources (68.75%); many students believed stars are not light sources because their light intensity is perceived as too dim.	Faulty everyday experience, cognitive limitations, lecture method without concrete media, incorrect prior conceptions, incomplete reasoning, and low learning interest.
7.	Riti et al. (2022)	*Identification of Science Misconceptions on the Properties of Light Using CRI with Grade V Students of SD Katolik St. Theresia Ende*	Most students held misconceptions on almost all properties of light (linear propagation, reflection, refraction, dispersion). Students believed all types of light share the same properties.	Low learning interest, faulty intuition, lecture method without concrete media or practicum, and incorrect examples provided by the teacher.
8.	Adi et al. (2024)	*Diagnosing Elementary School Students' Representation of Light Concept Through the Five-Tier Diagnostic Test*	Representational ability was dominated by Lack of Representation (39%) and Misconception (31%). Light dispersion was the most difficult sub-topic. Students assumed brightly coloured objects are light sources and that coloured light would strike other objects and its reflection would reach the eye.	Instruction has not employed a multi-representational approach; students are accustomed to a single mode of representation; and initial misconceptions derived from everyday experience.

Table 1 presents findings from several researchers on elementary school students' learning difficulties in understanding basic optical concepts, particularly on light and its properties. Based on the analysis of eight relevant journals, instruction on optical material continues to face various obstacles primarily the low level of students' conceptual understanding, as evidenced by high misconception rates across various sub-concepts such as reflection, refraction, light propagation, and shadow formation.

In the research of Hutasoit et al. (2025), it was found that most students did not yet understand the concept of light adequately, particularly regarding the properties of light and their application in everyday life. This difficulty was caused by the dominance of the lecture method and limited use of media and teaching aids, which made optical concepts abstract and difficult to understand. The lecture method alone is considered unsuitable for teaching optical material, as

concepts such as light, refraction, and dispersion tend to remain abstract when explained only through verbal description or book illustrations (Yulianti, Kasmini, & Mayang Sari, 2026). The situation differs when students directly practise optical concepts for example, by observing a spoon that appears bent inside a glass of water. Furthermore, the limitation of physical media, as encountered in the research of Hutasoit et al. (2025), can in fact be addressed through the use of virtual laboratories.

A virtual laboratory (*virtual laboratory*) is simulation software that represents the processes involved in laboratory activities (Okoyeigbo et al., 2020). It can also be understood as a computer-based programme enabling students to conduct experiments simulatively through a web platform (Ranjan, 2017). In the context of optics instruction, virtual laboratories constitute a relevant alternative for overcoming facility limitations while serving as effective media that can be used flexibly, both from the user's perspective and in terms of the laboratory system itself (Langngan, Tulandi, & Mandang, 2021). Research by Irfan et al. (2025) demonstrated that virtual laboratories are effective in science learning at the elementary school level: their use makes students more active, enthusiastic, and better able to understand abstract science concepts through simulated activities. In addition, virtual laboratories allow students the freedom to conduct experiments at any time and in any place, enabling them to extend their simulated experiences and gain more meaningful understanding. Alongside digital tools, the use of simple optical media made from everyday materials such as mirrors fashioned from aluminium foil, prisms made from transparent plastic filled with water, or torches with small apertures to demonstrate linear light propagation also represents a highly affordable and accessible alternative for elementary schools across various regions.

Research by Yantaviyani et al. (2026) showed that 29.66% of students held misconceptions and 26% did not understand the concepts, with difficulties occurring across almost all light sub-topics including reflection and refraction. The contributing factors included low student motivation and self-confidence. This low motivation cannot be viewed as a standalone factor. When considered alongside the findings of Riti et al. (2022) and Deviana and Desstya (2024), low motivation is a consequence of passive and meaningless learning experiences where students repeatedly receive information without the opportunity to observe, test, and reflect on their own understanding. This demonstrates that the internal and external factors causing misconceptions are interconnected, forming a causal chain that mutually reinforces each other. Breaking this chain requires instructional approaches that effectively build motivation while simultaneously providing active learning experiences, one of which is inquiry learning. In guided inquiry, students are engaged in collaborative investigative activities that develop and strengthen their science process skills (Hediana & Nurita, 2022). Inquiry-based learning positions students as active investigators who formulate questions, plan observations, collect data, and draw conclusions independently, so that light material which might otherwise feel abstract and meaningless can become concrete and relevant to students' real-world experiences.

Furthermore, research by Kurniasari and Nugroho (2025) revealed that student misconceptions remained high, particularly on the concepts of reflection, refraction, and shadow formation, due to weak basic conceptual understanding and the use of instructional strategies that provide insufficient opportunities for observation, experimentation, and reflection. To address misconceptions about light concepts in elementary school students, Kurniasari and Nugroho (2025) demonstrated empirically that the Predict-Observe-Explain (POE) strategy is effective in reducing misconceptions about light at the elementary school level. The success of this strategy lies in its instructional sequence, which encourages students to express and test their initial understanding. In the Predict stage, students are asked to state their hypotheses based on their existing knowledge or mental models. In the Observe stage, students conduct direct observation of the presented phenomenon, thereby receiving feedback on their predictions. In the Explain stage, students explain and compare their observations with their initial predictions in order to revise or reconstruct their conceptual understanding.

Other research by Rusnawati (2022) similarly showed that the application of the Predict-Observe-Explain (POE) model was proven to improve student learning outcomes, as evidenced by

increasing learning completion rates from the initial condition through successive cycles until they surpassed the established minimum mastery criterion (KKM). In optics instruction, the POE approach can be implemented through various activities such as predicting the direction of light on a convex mirror, determining the position of a shadow on a lens, or estimating colour changes as light passes through a prism all designed to surface and then correct misconceptions commonly held by elementary school students.

Meanwhile, Wulandari (2024) showed that misconceptions occurred across various sub-concepts, including light penetrating transparent objects (70%) and reflection (43%). This was influenced by weak prior understanding, limited instructional time, and insufficiently accurate delivery of material by the teacher. Compared with the findings of Nurfiyani, Putra, and Hermita (2020), who reported a 53.57% misconception rate on the sub-topic of light sources, and those of Yantaviyani et al. (2026), who found a 29.66% misconception rate on mirror properties, it is apparent that misconception rates tend to be higher on sub-topics requiring abstract thinking ability. Optical concepts that cannot be directly observed through the senses are more difficult for students to understand and thus more prone to generating misconceptions. These findings indicate that the more abstract a given optical sub-topic, the greater the likelihood of misconceptions arising. A more concrete, contextual instructional approach employing diverse representations is therefore needed to support more complete conceptual understanding.

Deviana and Desstya (2024) further found that students' conceptual understanding of light was very low, with only 8% genuinely understanding the concept while most others either did not understand or held misconceptions. These learning difficulties occurred particularly on the concepts of refraction and light propagation, caused by the minimal use of concrete media and the absence of diagnostic instruments to detect misconceptions. Without diagnostic assessment, teachers lack information about students' prior conceptions and are therefore unable to design instruction that is responsive to students' specific needs. Several studies have demonstrated that diagnostic assessment provides significant benefits in elementary school learning. Azis and Lubis (2023) affirm that cognitive diagnostic assessment within the Merdeka Curriculum aims to provide an accurate picture of elementary students' initial abilities, enabling teachers to design instruction that is genuinely aligned with students' understanding before new material is introduced. In line with this, Insani et al. (2023) explicitly showed that diagnostic assessment results in elementary schools should serve as the primary basis for designing differentiated instruction tailored to each student's individual needs and prior knowledge. Firmanzah and Sudibyo (2021) similarly found that the systematic implementation of diagnostic assessment in science learning helps teachers identify students' learning needs more accurately, thereby enabling instructional intervention to be directed more effectively.

Research by Nurfiyani et al. (2020) also showed that 53.57% of students held misconceptions, particularly on the concept of light sources, influenced by faulty everyday experience. Students' inaccurate everyday experiences such as believing that stars are not light sources because they appear dim, or that the moon is a light source because it appears to glow at night can form prior conceptions before classroom instruction takes place. Such prior conceptions are not easily corrected through lectures alone; they require a conceptual change approach capable of confronting students' initial understanding with different scientific facts. According to Rachmawati and Supardi (2021), conceptual change learning is effective in reducing misconceptions because it helps students revise their incorrect initial understanding through the process of cognitive conflict and active reconceptualisation, thereby prompting students to revise and reconstruct their understanding in a more scientific and active manner.

Additionally, research by Riti et al. (2022) revealed that most students experienced difficulty understanding almost all properties of light, caused in part by low learning interest. This can be explained through studies that consistently show that low interest and motivation in elementary science learning does not arise suddenly but is formed through an accumulation of meaningless learning experiences. Sari et al. (2025), who analysed factors behind low student learning motivation in elementary science, found that students' low self-confidence in their ability

to understand science concepts perceived as abstract and difficult is the most common intrinsic factor, further exacerbated when teachers fail to create an enjoyable and interactive classroom atmosphere (Rambe & Nukman, 2025). Similarly, Ernita and Sri Nindiati (2024) found that low learning motivation among Grade V students in science was caused by both internal student factors and external environmental factors, which interact and mutually reinforce one another, causing students to become increasingly disengaged from the learning process. In the context of optics instruction, abstract material that is insufficiently connected to students' concrete experiences can make students feel unable to succeed while also perceiving the material as lacking relevance ultimately reducing both their expectations of success and the value they assign to the learning.

Finally, Adi, Widodo, and Sopandi (2024) added that the limited application of a multi-representational approach is one of the important factors contributing to the low representational ability (lack of representation) of elementary school students. In optics instruction, multiple representations encompass students' ability to represent concepts in various forms, such as drawing ray diagrams, explaining the refraction process verbally, and using animations or simulations to visualise the movement of light. Limitations in mastering these diverse forms of representation contribute to the emergence of misconceptions. When students understand optical concepts only in a one-directional or incomplete manner, they tend to construct erroneous understandings, particularly for abstract concepts such as refraction, reflection, and shadow formation.

This situation arises because most science instruction in elementary schools remains teacher-centred and has yet to provide students with sufficient learning experiences to construct comprehensive conceptual understanding. Pratiwi (2022), through a systematic review, found that science instruction still dominated by a single mode of delivery such as verbal explanation alone is insufficient to build complete conceptual understanding, and that multi-representational teaching materials consistently improve students' conceptual understanding by enabling them to access scientific information through multiple pathways suited to their individual learning styles. In other words, the more diverse the representational forms presented in instruction, the greater the opportunity for students to build strong conceptual connections and to avoid partial or erroneous understanding.

Overall, the findings of this review indicate that elementary school students' learning difficulties in understanding basic optical concepts remain high and are influenced by a range of factors, both internal and external. Internal factors include low prior understanding, learning motivation, cognitive ability, and students' tendency to rely on faulty intuition. External factors include limited variety in instructional methods, dominance of lecture-based teaching, insufficient use of learning media, time constraints, and inadequate use of diagnostic instruments to identify misconceptions.

Based on the synthesis of various studies, misconceptions about light among elementary school students constitute a complex problem that cannot be resolved through any single instructional approach. A combination of complementary approaches is therefore required: early misconception identification through diagnostic instruments, application of a conceptual change approach to correct erroneous prior conceptions, the Predict-Observe-Explain (POE) strategy to encourage active observation and reflection, and inquiry learning to increase student engagement in the investigative process. In addition, the use of multiple representations, virtual laboratories, and simple optical media is also important for helping students visualise abstract concepts and connect them with concrete experience.

This combination of approaches is not merely a technical solution in instruction but also a pedagogical response to the identified root causes namely, instruction that remains focused on one-directional information delivery, leaving students with insufficient opportunities to observe, test, and actively construct their own understanding. Accordingly, improving basic optics instruction in elementary schools requires not only the replacement of the lecture method but a paradigm shift in learning toward a process that is more centred on the active, meaningful, and sustained construction of students' understanding.

CONCLUSION

Based on the literature review of eight relevant journals, it can be concluded that elementary school students' learning difficulties in understanding basic optical concepts remain high and constitute one of the important problems in science education. Research findings show that the majority of students experience misconceptions across various sub-concepts of light, including reflection, refraction, light propagation, shadow formation, and light dispersion. This low level of conceptual understanding indicates that students still encounter barriers in connecting scientific concepts with the phenomena they encounter in everyday life.

The learning difficulties experienced by students are influenced by various factors, both internal and external. Internal factors include low prior understanding, limited abstract thinking ability, low motivation and interest in learning, and reliance on intuition that is inconsistent with scientific concepts. External factors include the dominance of the lecture method, insufficient use of concrete media and teaching aids, limited practicum activities, constrained teaching time, and the suboptimal use of diagnostic instruments to identify student misconceptions. These conditions cause basic optical instruction to be predominantly theoretical, leaving students with insufficient meaningful learning experiences.

The findings of this review indicate that basic optics instruction in elementary schools requires a more interactive, contextual, and experience-based approach to enable students to understand concepts more deeply. It is therefore necessary to implement a range of integrated strategies: early misconception identification through diagnostic instruments, the use of a conceptual change approach to reconstruct students' erroneous understanding, and the application of the Predict-Observe-Explain (POE) model to encourage active observation and reflective learning. In addition, inquiry learning can increase student engagement in the process of concept discovery. The use of multiple representations, virtual laboratories, and simple optical learning media also plays an important role in helping students visualise abstract concepts, making them easier to understand and connect with real-world experience.

Although this study employed a literature review approach, the findings obtained can provide a comprehensive picture of the factors causing learning difficulties in basic optical material. These findings are expected to serve as a reference for teachers, researchers, and curriculum developers in designing more effective science instruction suited to the characteristics of elementary school students. Furthermore, additional research is still needed particularly empirical studies testing the effectiveness of various learning models, methods, and media in addressing students' learning difficulties and misconceptions in basic optical material across diverse instructional contexts.

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