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Resource Needs Assessment for Developing the Non- Textbook 'Persahabatan Besi dan Magnet' Based on the SDGs Framework in Junior High Schools

Sinta Srie Wulan✉, Bibin Rubini2, Didit Ardianto

Program Pendidikan IPA, Sekolah Pasca Sarjana, Universitas Pakuan, Indonesia

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Abstract

This study assessed the resource needs for developing a non-textbook titled "Persahabatan Besi dan Magnet" or "The Friendship of Iron and Magnets", designed to enhance conceptual understanding of magnetism among junior high school students. Using a quantitative descriptive method with survey techniques, data were collected from 31 science teachers and 28 ninth-grade students in Sukabumi City, West Java, Indonesia. The instrument consisted of closed and open-ended questionnaires focusing on the needs for learning media, preferred formats, and expectations for non-textbook content. The results show that teachers strongly prefer the inclusion of experimental activities (90.3%), visual illustrations (67.7%), contextual stories (64.5%), and links to video simulations (74.2%). Meanwhile, students indicated high interest in live experiments (75%), visual media, and science stories. In addition, teachers and students supported integrating environmental issues and technological innovation related to magnetism. These findings highlight the need for a contextual, visual, and narrative-based non-textbook aligned with the SDGs framework to support more meaningful and engaging science learning experiences in junior high schools.

✉ correspondence:
Jl. Pakuan No.I, RT.02/RW.06, Tegallega, Kecamatan Bogor Tengah, Kota Bogor, Jawa Barat 16129, Indonesia
E-mail: qoulansyadiida@gmail.com

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INTRODUCTION

The level of science literacy among junior high school students in Indonesia remains a pressing concern. Based on the 2023 Education

is consistent with findings from the Programme for International Student Assessment (PISA) in 2018 and 2022, which also indicated that the science literacy of Indonesian students remains relatively low (OECD, 2023). One of the primary contributing factors is the limited availability of teaching materials that effectively bridge abstract scientific concepts with students' everyday experiences.

In practice, the majority of schools continue to rely on textbooks that are dense with technical content and utilize language that is not easily accessible to students. Research by Sukmawati and Ruslan (2018) indicates that students often encounter difficulties in understanding the content of science textbooks, while teachers express the need for more varied, contextual, and communicative learning resources. Supporting this, Teguh (2020) identifies the lack of high-quality alternative instructional materials as the main barrier to implementing non-text books in classroom learning.

Textbooks commonly used in schools tend to employ complex language, which poses challenges for student comprehension. Consequently, there is a need for alternative instructional media that are narrative in nature, visually supported, and cognitively accessible. Several studies have demonstrated that non-text books or scientific storybooks can enhance students' motivation to learn, foster critical thinking, and improve understanding of scientific concepts (Setiawan & Handayani, 2019; Nugroho, 2020; Wahyuni & Wijayanto, 2019).

The selection of "iron and magnetism" as the focus material in this study is based on specific learning challenges encountered by both students and teachers. Based on a survey of 31 science teachers, the predominant issue reported was students' difficulty in understanding abstract concepts, particularly magnetic fields. A total of 87% of responses explicitly mentioned that students find it hard to grasp the notion of invisible forces and visualize phenomena such as Earth's magnetic field. Furthermore, many teachers also pointed out the lack of engaging instructional media and students' perception that the topic is not directly relevant to daily life. These challenges contribute to low interest and comprehension, which in turn affect learning outcomes. Therefore, a non-textbook designed to support visualization (e.g., through illustrations or animations), storytelling, and real-life contextualization is considered essential to bridge this gap and improve student engagement and conceptual understanding in the topic of magnetism.

Report of SMP Negeri 12 Sukabumi, only 62.22% of eighth-grade students achieved the minimum competency threshold in reading, including the ability to comprehend and evaluate both fictional and non-fictional scientific texts. This outcome

In response to this need, the development of a non-text book titled *"Persahabatan Besi dan Magnet"* is proposed as a potential solution to enhance student comprehension of magnetism concepts. This book is designed not only to promote science literacy but also to integrate sustainability values in accordance with three key Sustainable Development Goals (SDGs): SDG 4 (Quality Education), by offering inclusive and engaging learning access tailored to diverse learning styles; SDG 7 (Affordable and Clean Energy), by linking magnetism to the working principles of alternative energy technologies such as electromagnetic power generation; and SDG 12 (Responsible Consumption and Production), by encouraging students to reuse waste materials in creating simple science learning aids through storytelling and hands-on activities.

A review of relevant literature indicates that problem-based approaches (Rubini, 2020), the incorporation of socio-scientific issues (Rubini, 2019), and the strengthening of ecoliteracy (Rubini, 2022) are highly effective in improving science literacy (Kinslow et al., 2019; Afriandi et al., 2025). Nevertheless, there is a notable lack of research that specifically addresses the resource requirements for designing and implementing non-text books in the context of magnetism instruction at the junior high school level. Therefore, a preliminary needs analysis including supporting materials, content validation, teacher readiness, and student

responses is necessary prior to the development and implementation of such educational products.

METHODS

This study employed a quantitative descriptive design using a survey method. Data were collected through questionnaires administered to science teachers and ninth-grade students in junior high schools across Sukabumi City. The total sample consisted of 31 science teachers and 28 students, selected using random sampling techniques.

The instrument used was a questionnaire comprising closed- and open-ended questions. Items explored needs for non-textbook science materials, preferred media formats, instructional challenges, and student expectations related to magnetism learning.

To ensure quality, the questionnaire was reviewed by two science education experts for **content** validity. Their feedback was used to refine item clarity and relevance prior to administration.

Data analysis included:

- Descriptive statistics (frequencies and percentages) for closed-ended responses.
- Qualitative content analysis for open-ended responses to identify themes about learning difficulties and preferences.

RESULTS AND DISCUSSION

Teacher Survey Results

As part of the development of a more classroom-relevant science resource, a survey was conducted involving 31 science teachers to gather their preferences regarding the types of media that should be included in the nonfiction book titled *"Persahabatan Besi dan Magnet."* Respondents were allowed to select more than one type of media, based on their teaching practices and the kinds of content they believe would help achieve learning objectives.

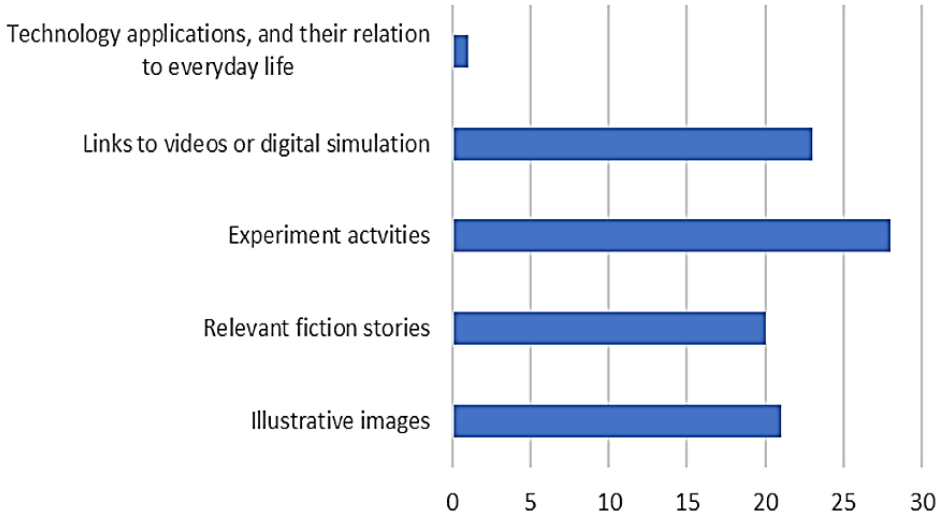

Figure 1. Media that Teachers Want Included in the Book

The survey results revealed that the majority of teachers (90.3%) wanted experiment activities to be included in the book. This indicates the strong preference for hands-on learning, which supports students in understanding scientific concepts in a tangible and meaningful way. Teachers see experiments as essential for encouraging curiosity, critical thinking, and the development of scientific process skills.

Furthermore, links to videos or digital simulations were also highly favored, with 74.2% of respondents supporting the inclusion of such media. This reflects the growing awareness among teachers of the value of digital tools in enriching classroom instruction, especially for visualizing dynamic scientific processes.

Other frequently chosen media included illustrative images (67.7%) and relevant fiction stories (64.5%). Visual illustrations are seen as effective in helping students comprehend

abstract concepts, while fiction stories can build context, enhance engagement, and connect science topics to everyday life or character-building themes.

One notable finding from the survey is the low percentage of teachers (only 3.2%) who selected applications of technology in everyday life as a preferred media type. This could suggest that teachers either find such content less engaging in a printed book format, or they feel that these applications are already implicitly represented through experiments and digital simulations.

Figure 2. Integration of Environmental Issues or Technological Innovation into Non-Text Books

All respondents agreed that the book to be developed should be integrated with environmental issues or technological innovation. This indicates a high level of awareness and need for the presence of non-text books that are relevant to current issues, making learning more contextual and engaging.

Student Survey Results

A total of 28 ninth-grade junior high school students participated in the survey. When asked about their preferred learning methods when studying magnets, the results were as follows:

Table 1. Student's Preferred Learning Styles

No	Learning Style	Number of Students
1	Live experiments	21
2	Video or animation	15
3	Reading stories	10
4	Illustrated or illustrated stories	8

Figure 3. The Need for Illustrative Images in Non-Text Books

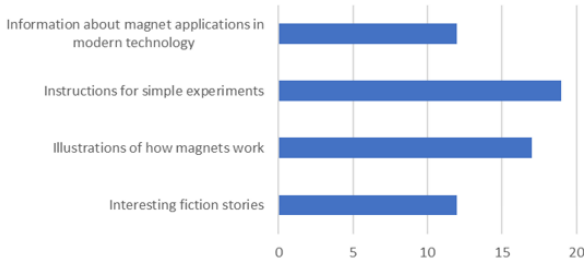

Figure 4. Students' Expectations of Non-Textual Books of Magnetism

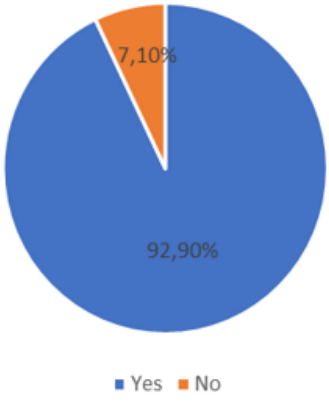

Figure 5. Students' Interest in Environmental Applications of Magnets

These findings confirm that students have a high level of interest in learning about magnets, but still face challenges in understanding abstract concepts. They desire non-text books that are more contextual, visual, experimental, and narrative. This finding aligns with previous research (e.g., Hanif, 2020; Teguh, 2020; Sari & Ramadhani, 2021; Gürsoy, 2021; Hamilton et al., 2021), which emphasizes the importance of learning media that combine images, stories, and experiments to facilitate the understanding of science concepts.

Discussion

The results of the survey indicate a significant gap between existing science textbooks and the learning needs of both teachers and students, particularly regarding the topic of magnetism. Teachers overwhelmingly expressed a preference for including experimental activities (90.3%) and digital simulations (74.2%) in the non-textbook to be developed. This reflects a shared understanding that abstract scientific concepts such as magnetic fields and electromagnetic principles require tangible, visual, and interactive approaches to enhance student comprehension.

This finding aligns with Ardianto and Rubini (2016), who emphasize that guided discovery and problem-based learning models, especially those involving hands-on experiments, are effective in improving scientific literacy. Experimental activities foster active learning, inquiry skills, and deeper cognitive processing, especially in abstract domains like magnetism. This is further supported by Hofstein and Lunetta (2004), who argue that laboratory activities not only increase students' engagement but also bridge the gap between theory and practice in science learning.

Visual aids, such as illustrations and animations, were also identified as essential components by 67.7% of teachers and many students. Visual representation helps bridge the gap between symbolic scientific language and concrete understanding, particularly for junior high school students whose cognitive development is still at the concrete operational stage (Piaget, in Setiawan & Handayani, 2019). Bongers et al. (2020) and Ainsworth (2006) further highlights that multiple representations, including diagrams and animations, promote deeper learning and better mental model construction. Treagust, Duit, and Fischer (2014) also emphasize that visual tools are essential for conceptual change in science education, particularly for abstract topics such as magnetism.

Students also demonstrated high interest in contextual stories and science fiction elements (64.5% of teachers supported this inclusion), suggesting the potential of narrative to enhance emotional engagement and memory retention. This corresponds with the findings of Badeo et al. (2021), Penuel et al. (2022) and Nugroho (2020), who found that scientific storybooks improve both conceptual understanding and student motivation. Norris and Phillips (2003) assert that narrative-based resources strengthen the link between literacy and science, while Sadler, Barab, and Scott (2007) argue that socioscientific narratives enhance students' reasoning and connection to real-world issues.

Interestingly, a small portion of teachers (3.2%) expressed interest in including technological applications in everyday life, which may reflect a lack of familiarity with integrating socio-technological content in print-based media. However, this may also highlight the need for professional development regarding how to contextualize magnetism with sustainable technologies such as maglev trains or electromagnetic energy generators as envisioned in SDG 7 (Affordable and Clean Energy).

Another noteworthy theme from the student responses was the difficulty in understanding abstract concepts. The open-ended responses overwhelmingly emphasized challenges in visualizing invisible forces such as magnetic fields and the Earth's magnetism. This supports prior research by Wahyuni & Wijayanto (2019), which emphasizes the need for conceptual simplification and analogical reasoning in science materials for adolescents.

Moreover, both students and teachers expressed enthusiasm for integrating environmental themes. This is in line with Rubini (2022), who promotes eco-literacy and the use of science instruction to raise awareness of sustainable practices. The use of waste materials to build simple magnetic tools, for instance, provides a tangible way to connect scientific concepts with SDG 12 (Responsible Consumption and Production). UNESCO (2017) further encourages aligning science learning with sustainability goals through context-based educational design.

Overall, the findings reinforce the need for multimodal, narrative-based, and environmentally contextualized science resources. These elements not only support students' cognitive development but also nurture their affective and social understanding of science. A non-textbook like "Persahabatan Besi

dan Magnet" which combines illustration, storytelling, experimentation, and sustainability can address these gaps and serve as a model for teaching other abstract scientific topics in junior high school settings.

CONCLUSION

This study found a strong demand for alternative science learning resources, especially in teaching the topic of magnetism at the junior high school level. Both teachers and students expressed a clear preference for instructional materials that are contextual, visual, narrative-driven, and include experimental activities. These results confirm the gap between conventional textbooks and students' learning needs.

The findings support the development of a non-textbook such as *"Persahabatan Besi dan Magnet"* that integrates visual illustrations, fictional narratives, live experiments, and sustainability themes aligned with the SDGs framework. This resource can potentially enhance student engagement, motivation, and science literacy.

Implication: Curriculum developers, educational publishers, and science educators should consider adopting multimodal, SDG-linked content when designing teaching resources, especially for abstract scientific topics like magnetism.

Limitations: The study was limited to a small number of schools in one region, which may not represent broader national conditions.

Recommendation**:** Future research should evaluate the effectiveness of the developed non-textbook in classroom implementation and its impact on student learning outcomes across different regions and student groups.

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