



# Development of SDG-Oriented Natural and Social Sciences Teaching Materials Using Mind Mapping for Grade IV Elementary School Students

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**Abstract:** This research aims to develop valid, effective, and practical teaching materials based on mind mapping for Natural and Social Sciences (IPAS) subjects for fourth grade elementary school students, which is motivated by low learning outcomes and student motivation due to the use of less interesting conventional materials. The method used is development with the ADDIE model (Analysis, Design, Development, Implementation, Evaluation), with data collected through class observation, interviews, expert validation, questionnaires, as well as pre-tests and post-tests. The results of validation by material, media, and language experts show that the teaching material is very valid with Aiken's V scores of 0.97, 0.89, and 0.97, respectively. An effectiveness test with an N-Gain score showed a significant improvement in learning outcomes, with scores of 0.7765 (small group) and 0.7971 (large group), both in the high category. The paired sample t-test showed a significance value of  $p = 0.000$  ( $< 0.05$ ), indicating a significant difference between the pre-test and the post-test. In terms of practicality, the teaching materials received a very positive response from teachers (96.36%) and students (93.25%), which showed that the materials were easy to use, interesting, and helped the understanding of IPAS concepts. Thus, the mind mapping-based teaching materials developed in this study have proven to be feasible to improve the quality of science learning in fourth grade basic education.

**Keywords:** ADDIE; Independent curriculum; IPAS; Mind mapping; Teaching material

## Introduction

The development of innovative and effective teaching materials is an important element in efforts to improve the quality of education (Dinda et al., 2025; Lubis & Albina, 2025; Wibowo et al., 2025). In the learning of Natural and Social Sciences (IPAS) at the elementary school (SD) level, well-designed teaching materials can help students understand complex concepts, optimize creativity, and build critical thinking skills. Therefore, this research focuses on the development of Mind mapping-based teaching materials for grade IV elementary school students, which are expected to be able to answer existing learning

challenges and support the achievement of national education goals.

In an ideal education system, teaching materials not only function as a medium to convey information, but also as a facility to create an interactive, fun, and meaningful teaching and learning process (Dinda et al., 2025; Duludu, 2017; Putri et al., 2025; Trikesumawati et al., 2025; Zahwa & Syafi'i, 2022). In an ideal education system, teaching materials not only function as a medium to convey information, but also as a facility to create an interactive, fun, and meaningful teaching and learning process according to Ali et al. (2024) and Kurniawan & Zabeta (2025), can increase student motivation and engagement, which ultimately plays a role in achieving learning outcomes.

## How to Cite:

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One solution to increase learning effectiveness is to use Mind mapping as a teaching material. Mind mapping is an information organizing technique that uses diagrams to visualize the relationships between concepts (Betancur & King, 2014; Davies, 2011; Eppler, 2006; Faradiba & Bahri, 2024; Trevino, 2005). The use of this technique in learning can help students organize information systematically, making it easier for them to understand material related to the natural and social sciences. By using visual aids such as mind mapping, students can more easily understand interrelated concepts (Ardiansyah et al., 2025; Rahmawati & Budiningsih, 2014). However, the current conditions in many primary schools show that most of the teaching materials used are still conventional and tend to be monotonous. Based on the results of observations at SD Negeri 12 Koto Gadang, it was found that many of the teaching materials used were less attractive and ineffective. The monotonous use of package books leads to low achievement of students' learning outcomes, which only reach 40% of the expected criteria (Rachmawati et al., 2022). Therefore, there is an urgent need to develop more interactive and innovative teaching materials, such as mind mapping, that can increase students' motivation and engagement in learning.

In addition, many teachers face difficulties in implementing the Merdeka curriculum due to a lack of understanding of the design of teaching materials that are in accordance with the set pedagogical standards (Lestari et al., 2023; Nurnaifah, 2024). Teachers often rely only on lectures and textbooks as the main source in the learning process, which results in low motivation for students' learning. This also causes low learning achievement of students at the elementary school level. To overcome this problem, innovation in the development of teaching materials is a must.

Previous research has shown that the use of Mind mapping in learning can significantly increase student engagement (Khairiyah, 2024; Priyanata et al., 2025; Purnama et al., 2024). This technique assists learners in organizing and connecting concepts that were previously considered separate, thereby improving their understanding of the material being studied. Mind mapping also encourages learners to think creatively and critically, which is an important skill in dealing with the challenges of the 21<sup>st</sup> century.

In the context of learning IPAS, the use of Mind mapping is very relevant, considering that the material often involves various interrelated concepts (Puspitasari et al., 2024; Sukardi et al., 2025). For example, in learning about plants, mind mapping can help students understand the relationship between concepts such as photosynthesis, how to reproduce, and plant types. By

using Mind mapping, students can see the big picture of the material being studied and understand the relationship between concepts more clearly.

The development of Mind mapping-based teaching materials is also supported by technological advances that can increase learning effectiveness. Fitria & Muthi (2024), Mutia et al. (2025), and Putra & Pujani (2024) noted that the use of interactive e-modules can enrich the learning experience of students and make learning more interesting. The integration of technology in the development of Mind mapping-based teaching materials provides greater flexibility for students to learn independently, which in turn can improve the quality of learning in elementary schools.

## Method

This research uses the development research (R&D) method with the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model (Adriani et al., 2020; Weldami & Yogica, 2023). The ADDIE model was chosen for its systematic and structured measures, which allow for the development of valid, effective, and practical teaching materials. This study combines quantitative and qualitative approaches, with data obtained through learning outcome tests, student response questionnaires, and observations.

The first stage of analysis involves identifying needs through interviews with teachers and observations in the classroom to understand students' difficulties in understanding science materials. This stage also includes an analysis of the Merdeka curriculum and literature studies related to mind mapping in learning. In design, teaching materials are designed based on the results of analysis, with specific learning objectives and materials that are structured in a structured manner. Visual design is also considered to increase the appeal of students.

In the development stage, teaching materials are arranged according to designs that have been made and validated by material experts, media, and teachers to ensure their quality and suitability with the curriculum. After that, the teaching materials were tested in implementation with limited trials in the classroom. Based on the results of the trial, the teaching materials were revised and tested again in extensive trials to ensure their effectiveness. The evaluation was carried out by analyzing limited and extensive trial results data to assess the effectiveness, validity, and practicality of teaching materials. Based on the results of the evaluation, the teaching materials were improved and prepared for permanent use.

The research instruments include validation questionnaires, learning outcome tests, student response questionnaires, and observation sheets. The data was analyzed using descriptive statistics and statistical tests to measure the effectiveness, practicality, and validity of teaching materials, with the aim of producing interesting and effective mind map-based teaching materials in improving students' understanding of IPAS materials.

## Result and Discussion

This research develops teaching materials based on mind mapping using the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model.

### *Analysis Stage*

This stage aims to identify learning problems faced by teachers and students. The results of observations show that science learning in grade IV of elementary school is still conventional, where teachers are more dominant in using lectures and students tend to be passive. Interviews with teachers revealed the need for more visual and interactive teaching materials, in accordance with the Independent Curriculum, to increase student engagement in learning.

### *Design Stage*

Mind mapping-based teaching materials are designed with a structure that includes the main theme, learning outcomes, learning objectives, subject matter, and practice questions. Each element in the mind map is organized interactively, where each branch can be clicked to display relevant content. The visual design of teaching materials uses bright colors, attractive icons, and easy-to-read fonts to support students' learning styles, so that students can more easily understand and engage in the learning process.

### *Development Stage*

This stage involves creating mind mapping-based teaching materials with design applications such as Canva and MindMeister. These teaching materials are then validated by material, media, and language experts to ensure their feasibility and quality. Validation results showed that the teaching materials met the high eligibility criteria in all aspects, with Aiken's V scores of 0.977 for the material, 0.898 for the media, and 0.972 for the language, respectively, all of which fell into the "Valid" category.

### *Implementation Stage*

The implementation stage of teaching materials is tested in small and large groups. The results of the trial

showed that this teaching material was very practical to use, with the teacher's practicality score reaching 96.36%, which was included in the category of "Very Practical". Teachers appreciate the systematic presentation of teaching materials, attractive visual appearance, and ease of use and relevance to student needs. Meanwhile, learners gave an average percentage of practicality of 93.25%, which indicates that they found the teaching materials easy to use, engaging, and helpful for them to understand the material. The effectiveness of teaching materials was tested using pre-test and post-test in small and large groups. The results of the analysis using N-Gain showed that the small group had an average N-Gain of 0.7765 (high category), while the large group showed an N-Gain of 0.7971 (high category), which signified a significant improvement in learning outcomes. The results of the Paired t-Test showed a significant difference between pre-test and post-test scores, with a very strong correlation ( $r = 0.978$ ) in both groups. This indicates that mind mapping-based teaching materials are effective in improving student understanding.

### *Evaluation Stage*

The evaluation of practicality and effectiveness shows that teaching materials are very practical and effective in learning science in grade IV elementary school. This teaching material meets the criteria to be applied more widely, supporting learning based on the Independent Curriculum with significant results in improving student learning outcomes.

## Conclusion

The development process of mind mapping-based teaching materials follows the five stages of the ADDIE model: Analysis, Design, Development, Implementation, and Evaluation. The analysis stage identifies the need for visual and interactive teaching materials according to the characteristics of the students. The design creates a structure of teaching materials with learning elements, and the development stage results in an interactive digital product based on Canva, validated by material, media, and language experts who demonstrate that the teaching materials are worth using. The validity of the teaching materials was declared valid with an Aiken's V score of 0.977 for the material, 0.898 for the media, and 0.972 for language. The practicality of the teaching materials was considered very practical, with 96.36% responses from teachers and 93.25% from students. The effectiveness of the teaching materials showed a high N-Gain score in the small (0.7765) and large (0.7971) groups, and the t-test showed a significant increase in student learning outcomes ( $p < 0.05$ ).

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### Author Contributions

Conceptualization, writing—original draft preparation, visualization, I.S. and R.H.; methodology, software, formal analysis, investigation, resources, I.S.; validation, writing—review and editing, R.H., D., and Z.Z. All authors have read and agreed to the published version of the manuscript.

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### Conflicts of Interest

The authors declare no conflict of interest.

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