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Development of Guided Inquiry-Based Electronic Student Worksheets (E-LKPD) in IPAS Learning for Grade IV Elementary School Students

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Abstract: This study aims to develop an Electronic Student Worksheet (E-LKPD) based on the guided inquiry model for IPAS learning in Grade IV elementary school students. The E-LKPD was developed using the 4-D model, which consists of the Define, Design, Develop, and Disseminate stages. The results show that the E-LKPD has very high validity, with material validity scoring 95%, media validity 83%, and language validity 100%. The practicality test conducted at SDN 01 Batang Palupuh showed that the product is highly practical, with teacher ratings reaching 91% and student ratings at 91.1%. The effectiveness of the E-LKPD was tested using pre-test and post-test designs, which showed a significant improvement in student understanding, with an N-Gain score of 0.58. Based on the trial results, it can be concluded that the E-LKPD based on the guided inquiry model is effective in enhancing student engagement and understanding of IPAS concepts in Grade IV elementary school students.

Keywords: E-LKPD; Guided inquiry; IPAS

Introduction

Education plays an essential role in developing students' knowledge, character, and higher-order thinking skills (Pristiwanti et al., 2022). At the elementary level, learning activities should support balanced cognitive, affective, and psychomotor development. In Grade IV, Integrated Science and Social Studies (IPAS) requires meaningful learning experiences that connect concepts with real-life contexts to strengthen students' conceptual understanding.

However, IPAS learning in elementary schools still faces practical challenges. Interviews with teachers at SDN 01 Batang Palupuh indicate that learning media remain conventional, primarily using printed textbooks, worksheets (LKPD), and PowerPoint slides. Such practices create monotonous learning environments, limit student interaction, and contribute to passive classroom participation. This condition is reflected in students' low academic performance, with an average daily test score of 55, below the Minimum Completion Criteria (KKM) of 70. Learning that emphasizes theoretical delivery without active engagement tends to reduce students' understanding of concepts (Sunaryati et al., 2024). These findings highlight the need for more interactive and student-centered learning media.

Advances in educational technology provide opportunities to improve learning effectiveness. Digital learning materials can enhance engagement, enrich learning experiences, and support better learning outcomes (Rahayu et al., 2023). One potential solution is the Electronic Student Worksheet (E-LKPD), which enables interactive and flexible learning through multimedia integration.

In addition to learning media, instructional models play a crucial role in fostering active learning. The guided inquiry model promotes student involvement

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in structured discovery processes while teachers act as facilitators (Setiani et al., 2022). This model has been shown to improve conceptual understanding and higher-order thinking skills compared to conventional approaches (Latukau, 2022). Therefore, combining interactive digital media with guided inquiry has strong potential to enhance the quality of IPAS learning.

Previous studies have shown that guided inquiry-based E-LKPD improves conceptual understanding and critical thinking skills (Riyatno & Hayuhantika, 2023; Sari & Yuliana, 2020). However, most existing studies focus on general science subjects, non-integrated curricula, or conventional digital formats. Research specifically addressing guided inquiry-based E-LKPD for IPAS learning in elementary schools remains limited. Moreover, the integration of guided inquiry learning stages with interactive multimedia developed using Articulate Storyline has not been widely explored.

This study addresses these gaps by developing a guided inquiry-based E-LKPD specifically designed for Grade IV IPAS learning on the topic of changes in the state of matter. The novelty of this study lies in the integration of structured guided inquiry stages with interactive multimedia features developed through Articulate Storyline to create a more engaging and meaningful digital learning experience.

This research is important because it responds directly to classroom learning problems, supports the need for interactive digital learning media, and provides practical instructional tools for teachers implementing student-centered learning. Therefore, this study aims to develop a guided inquiry-based E-LKPD for Grade IV IPAS learning; examine its validity and practicality; and evaluate its effectiveness in improving students' conceptual understanding.

Method

Research Design

This study employed a Research and Development (R&D) approach to develop and validate a guided inquiry–based Electronic Student Worksheet (E-LKPD) for IPAS learning in Grade IV elementary school. The development process adopted the 4-D model proposed by Thiagarajan et al. (1974), which consists of four stages: Define, Design, Develop, and Disseminate. This model was selected due to its systematic and structured framework for producing and evaluating educational products. The development process is illustrated in the diagram in Figure 1.

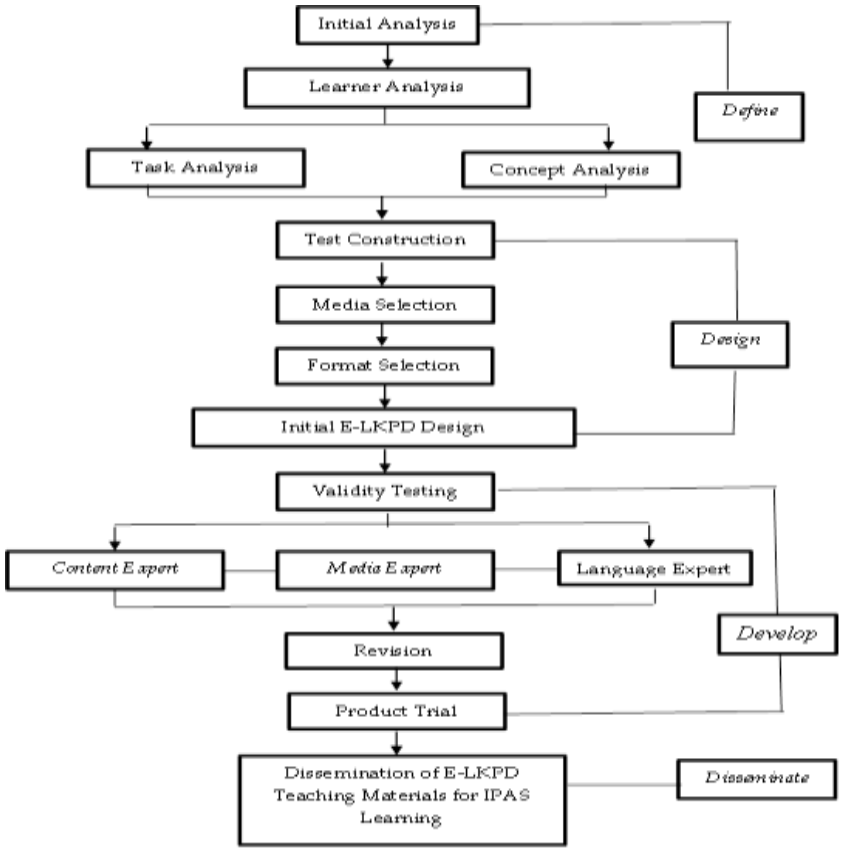

Figure 1. 4-D model development procedure

In the Define stage, a needs analysis was conducted through curriculum review, classroom observation, and teacher interviews to identify problems in IPAS learning and limitations of existing teaching materials. The results of this analysis served as the basis for determining the development objectives of the E-LKPD.

In the Design stage, a prototype of the guided inquiry–based E-LKPD was developed by determining learning objectives, organizing content structure, designing learning sequences, and integrating interactive multimedia features such as images, videos, and web-based activities. The learning design followed the guided inquiry syntax: orientation, problem formulation, data collection, data processing, and conclusion.

In the Develop stage, the prototype was evaluated through expert validation to ensure content accuracy, media quality, and language clarity. Revisions were made based on validators' suggestions. The revised product was then implemented in a limited trial involving teachers and students to evaluate its practicality and effectiveness.

In the Disseminate stage, the finalized product was distributed to a broader educational setting to examine its applicability and user acceptance.

Research Subject

The research subjects of this study consisted of eighteen Grade IV students at SDN 01 Batang Palupuh who participated in the product trial and learning outcome assessment, one IPAS teacher who evaluated the practicality of the developed E-LKPD.

Data Collection and Analysis

This study employed both quantitative and qualitative data collection techniques. Quantitative data were obtained from validation results, practicality assessments, and students' pre-test and post-test scores. These data were analyzed using descriptive statistics in the form of mean scores and percentages. The effectiveness of the E-LKPD was determined using the N-Gain formula to measure improvement in learning outcomes.

Qualitative data were collected through teacher interviews and classroom observations during product implementation. These data were analyzed thematically to support and enrich the interpretation of quantitative findings.

Result and Discussion

Result

This study aimed to develop an Electronic Student Worksheet (E-LKPD) based on the guided inquiry model for IPAS (Integrated Science and Social Studies) learning for Grade IV elementary school students. The E-LKPD was developed using the 4-D model, consisting of Define, Design, Develop, and Disseminate stages. The results show that the E-LKPD is highly valid, practical, and effective in enhancing student engagement and understanding of IPAS concepts.

Table 1. The results of the material validation

Variable Criteria	Variable average
Content Quality	4.8
Conceptual Correctness and Suitability	4.5
Currency and Contextuality	5
Total	14.3
Percentage (%)	95
Criteria	Highly valid

Table 2. The results of the media validation

Variable Criteria	Variable average
Appearance	4.2
Use of Fonts	4
Suitability to the Guided Inquiry Model	4
Total	12.5
Percentage (%)	83
Criteria	Highly valid

Table 3. The results of the language validation

Variable Criteria	Variable average
Conformity to Language Rules	5
Sentence Appropriateness	5
Conformity to Students	5
Total	15
Percentage (%)	100
Criteria	Highly valid

Validation by experts was carried out by experts in content, media, and language, with results showing high validity. The content expert gave a validity score of 95%, the media expert gave a score of 83%, and the language expert gave a score of 100%. This proves that the content of the E-LKPD is accurate, relevant, and clear to the target audience. Following this, a practicality test was conducted at SDN 01 Batang Palupuh.

Table 4. Results of teacher practicality trials

Variable Criteria	Variable average
Ease	4.2
Material Presentation	5
Appearance	4.8
Guided Inquiry	4.7
Effects on Learning Strategies	4.3
Total	22.9
Percentage (%)	91
Criteria	Very Practical

Based on Tables 4 and 5, the E-LKPD was tested for practicality by both teachers and students. The teacher's response rate reached 91%, and the student's response rate was 91.1%, indicating that this product is highly practical. Both teachers and students felt that the E-LKPD is easy to use and supports structured inquiry-based learning.

Table 5. Results of student practicality trials

Variable Criteria	Variable average
Ease	4.49
Material Presentation	4.61
Appearance	4.48
Guided Inquiry	4.57
Effects on Learning Strategies	4.62
Total	22.77
Percentage	91.1%
Criteria	Very Practical

Table 6. N-Gain test results

Information	Pre-test	Post-test
Amount	930	1431
average	51.67	79.5
N-gain		0.58
N-gain percentage		57.99%
Category		Medium

Based on Table 6 the effectiveness of the E-LKPD was tested using a pre-test and post-test design. The average score of students increased from 51.67 on the pre-test to 79.5 on the post-test, with an N-Gain score of 0.58, categorized as moderate. This shows that the use of the E-LKPD significantly improved students' understanding of the material.

Discussion

The findings indicate that the guided inquiry–based E-LKPD is pedagogically appropriate and feasible to support IPAS learning in Grade IV elementary school. The strong feasibility of the product suggests that its instructional structure, content organization, and language clarity are aligned with students' developmental characteristics. The integration of inquiry syntax into each learning stage also ensures that students engage in a structured process of observing, questioning, exploring, and concluding, which is essential for conceptual learning at the elementary level.

From a usability perspective, the positive responses from teachers and students reflect that the digital worksheet is practical for classroom implementation. Its intuitive navigation, clear activity flow, and multimedia-supported instructions reduce cognitive load and allow students to focus on learning tasks rather than technical operation. This practicality is important because instructional media that are difficult to operate often hinder learning effectiveness despite having strong content quality.

The inclusion of interactive multimedia elements such as learning videos, formative quizzes, and drag-and-drop activities also contributes to a more student-centered learning environment. These features stimulate active exploration and provide immediate feedback, enabling students to monitor their own understanding. Suhelayanti et al. (2023) emphasize that interactive digital media increase learning motivation by creating meaningful engagement between learners and instructional content. In this context, the developed E-LKPD functions not merely as a digital worksheet but as an interactive learning environment that supports inquiry processes.

Regarding learning effectiveness, the moderate improvement in learning outcomes indicates that the E-LKPD meaningfully supports students' conceptual understanding, although its impact has not yet reached an optimal level. This result implies that while students benefited from guided exploration activities, several factors may have limited stronger gains. First, students may still be adapting to digital inquiry-based learning, particularly if they are more accustomed to teacher-centered instruction. Second, the implementation period was relatively short, limiting opportunities for repeated practice and deeper conceptual reinforcement. Third, the complexity of IPAS material requires sustained scaffolding, which may need to be strengthened in future revisions of the worksheet.

These findings are consistent with previous studies highlighting the effectiveness of inquiry-based learning in strengthening conceptual mastery and higher-order thinking. Ayuningtias et al. (2024) explain that inquiry learning promotes deeper understanding by encouraging learners to actively construct knowledge rather than passively receive information. Similarly, Latukau (2022) and Mandjur (2024) report that guided inquiry improves students' ability to connect concepts with real-life contexts, an essential competency in IPAS learning. The present study extends this evidence by demonstrating how inquiry principles can be effectively embedded into interactive digital worksheets for elementary education.

The moderate effectiveness also provides important direction for further development. Enhancing visual communication, expanding contextual problem scenarios, and diversifying practice activities may help students engage more deeply with the material. Wulandari et al. (2024) argue that varied learning resources strengthen learner interaction and improve knowledge retention. Therefore, enriching multimedia variation and increasing task complexity could potentially lead to higher learning gains.

Overall, the developed E-LKPD contributes to improving the quality of IPAS instruction by providing a structured, interactive, and student-centered learning tool. It supports the shift toward active learning practices and aligns with the demands of twenty-first century education, which emphasize digital integration, critical thinking, and learner autonomy.

Conclusion

The guided inquiry-based E-LKPD for Grade IV IPAS learning is valid, practical, and effective. Expert validation confirms high quality, and user testing shows it is easy to use and supports interactive learning. Its effectiveness is indicated by improved learning outcomes, with an N-Gain score of 0.58 (moderate), reflecting a meaningful increase in students' conceptual understanding. These findings highlight the E-LKPD as a useful digital resource to support inquiry-based learning and student engagement in elementary classrooms. Teachers are encouraged to implement this media, and future research should involve wider samples and enhanced interactive features to optimize learning outcomes.

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Conceptualization, methodology, D. F. J. Z.; validation, M. R. A. S. 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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