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Development of AI-Based Hypercontent E-LKPD for IPAS Learning in Grade V Elementary School

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Abstract: Learning that still relies on conventional methods, such as lectures and textbooks, often fails to facilitate understanding of complex concepts, especially in subjects like Natural and Social Sciences (IPAS), which require in-depth and contextual understanding. Learner-centered education should be enhanced through innovative learning media, including the use of AI-based Hypercontent E-Worksheets (E-LKPD) to assess learning effectiveness. This study aims to develop a valid, practical, and effective AI-based Hypercontent E-LKPD for IPAS (Social and Natural Sciences) learning in Grade V of elementary school. The research was conducted in Class V of SDN 10 Sekayu with 50 student participants. The study followed a Research and Development (R&D) approach using the Rowntree development model and Tessmer's formative evaluation. Data were collected through interviews, questionnaires, expert reviews, one-to-one and small group evaluations, and pretest-posttest. The validity score of the developed E-LKPD was 4.62 (very good). Practicality scores were 4.6 (one-to-one) and 4.42 (small group), both considered very practical. Effectiveness was measured through learning outcomes, showing a pretest score of 42.50%, a posttest average of 84.75%, and an N-Gain of 0.72 (high category). These results indicate that the developed AI-based Hypercontent E-LKPD is valid, practical, effective, and highly suitable for use in IPAS learning for Grade V elementary students.

Keywords: Elementary school; E-LKPD; Hypercontent; IPAS

Introduction

The role of technology in this era has become a necessity for every teacher and student. Globally, technology is recognized as a key factor in improving the quality of learning, transforming teaching methods, and enhancing student learning outcomes (Haleem et al., 2022; Mena-Guacas et al., 2025). Rapid advances in science and technology have fundamentally changed the global educational landscape (Boateng et al., 2024; Ng et al., 2025), necessitating a shift toward a more student-centered and technology-integrated learning approach. In today's digital era, educators are required to possess digital skills and critical thinking skills to create meaningful learning experiences (Kiryakova & Kozhuharova, 2024; Basilotta-Gómez-Pablos et al., 2022). Technology plays a crucial role in improving the quality of learning (Ebadi & Ashrafabadi, 2022; Hek & Kraaykamp, 2023), facilitating better access to materials, and strengthening student understanding (Masruddin et al., 2024). One of the main challenges in today's education is how to design a learning process that is both effective and relevant to the needs and potential of each student (Oo et al., 2024; Deroncele-Acosta & Ellis, 2024). To address this challenge, the integration of Artificial Intelligence (AI) in education is growing.

AI-based educational technology offers various advantages such as personalized feedback, adaptive learning environments, and interactive material delivery (Nazaretsky et al., 2025; Susanti & Sholihah, 2021),

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thereby improving student engagement and learning outcomes (Manu et al., 2023). To achieve active learning, digital teaching materials need to be developed beyond static content. AI-based hypercontent allows students to navigate various types of media and learning resources in an integrated manner (Herawati et al., 2024), thus supporting independence and learning engagement (Nurpratiwi et al., 2023). Furthermore, platforms like Wordwall, combined with AI-based visuals and animations, can be an innovative solution for explaining abstract concepts, particularly in subjects like Natural and Social Sciences (IPAS) (Fu'adah & Ratnaningrum, 2024; Yulia & Suttrisno, 2024). In the context of the Independent Curriculum in Indonesia, the science and social studies subjects have been integrated into the IPAS.

However, in practice, learning is still dominated by lectures and the use of printed worksheets (LKPD), which are monotonous, making them less engaging and interactive, especially for topics such as Natural Phenomena and Their Changes (Fu'adah & Ratnaningrum, 2024; Narulita et al., 2024). Given the availability of digital infrastructure in many schools and the needs of 21st-century students, this research aims to develop a hypercontent- and artificial intelligence-based e-LKPD for fifth-grade science learning in elementary schools. The primary goal is to produce valid, practical, and effective digital teaching materials that increase student engagement, facilitate conceptual understanding, and support independent exploration through interactive media and adaptive content.

Method

This study employed a Research and Development (R&D) method, adapting Rowntree's development model, which encompasses three main stages: planning, development, and evaluation. The evaluation employed Tessmer's formative evaluation approach, which included self-evaluation, expert review, one-to-one interviews, small group interviews, and field testing (Anjarwati et al., 2025). The study subjects consisted of 50 fifth-grade students at SDN 10 Sekayu. The data analysis technique employed was walk-through data analysis, a data validation process that evaluates data using a validation questionnaire administered to experts using a Likert scale. Scores are calculated by categorizing validation values. Furthermore, one-to-one and small group data analysis techniques were used to test the practicality of the E-LKPD product being developed. The following formula was used to calculate the percentage of results:

$$P = \frac{f}{N} \times 100\% \quad (1)$$

Information:
P: Final Value
f: Score obtained
N: Maximum score

The final score obtained is confirmed through the practicality category of the developed E-LKPD. The practicality category can be seen in Table 1.

Table 1. Categories of one-to-one and small group test results

Percentage (%)	Category
0–20	Not very practical
21–40	Not practical
41–60	Quite practical
61–80	Practical
81–100	Very practical

To determine effectiveness, it is measured through improvements in student learning outcomes by calculating the N-Gain score between pretest and posttest results. To obtain the N-gain Score, the following formula is used:

$$N_{gain} = \frac{S_{posttest} - S_{pretest}}{S_{maximum} - S_{pretest}} \quad (2)$$

Description:
N-Gain = normalized gain score
Initial test score = average initial test score
Posttest score = average final test score
Maximum score = maximum score

High or low N-Gain can be clarified in Table 2 as follows.

Table 2. N-Gain level criteria

N-Gain	Description
g ≥ 0.70 High	High
0.70 > g ≥ 0.30	Medium
g <0.30	Low

Result and Discussion

Research Results

The results of this research are an AI-based Hypercontent E-LKPD for science learning on Natural Phenomena and Their Changes. The planning stage is the initial step of the research. This stage involves conducting a needs analysis, determining learning objectives, defining learning strategies and ideas, selecting a development and support platform for the E-LKPD, and conducting interviews with fifth-grade teachers at the school where the research was conducted. Based on the interview results, it was found that: Students showed a lack of focus and interest during learning activities; Students tended to be unmotivated to

learn enthusiastically and easily became bored with the learning process; Many students still made mistakes in completing evaluation questions, one of the materials that often gave rise to misconceptions was the topic of Natural Phenomena and Their Changes; students' low conceptual understanding was the cause of the errors in completing the questions on Natural Phenomena and Their Changes; and the current media used was not optimal because it relied on rudimentary media, despite the school's relatively complete facilities. The school had not yet used a self-developed E-LKPD, such as the AI-Based Hypercontent E-LKPD.

Figure 1. Several displays of the AI-based hypercontent E-LKPD

The development stage then consists of three steps: selecting ideas, creating a flowchart, and creating a storyboard. In the idea selection stage, researchers selected ideas based on the principle of selecting concepts relevant to learning objectives and student characteristics. Based on the results of the needs analysis, researchers determined the development idea for the Hypercontent E-LKPD, considering the resources and facilities available to students. The ideas then focused on the needs analysis obtained. After developing the ideas, a flowchart and storyboard layout were created. The resulting E-LKPD produced a prototype storyboard, which was then evaluated. The evaluation stage began with self-evaluation. This stage involved self-assessment and consultation with a supervisor. This aimed to address any shortcomings in the E-LKPD being developed. The evaluation was then conducted through expert review. The goal was to obtain an AI-based Hypercontent E-LKPD that was validated by three experts. The validation results from this stage can be seen in Table 3.

Table 3. Expert validation results

Expert Validation	Result	Maximum Score	%	Average	Category
Media	50.30	55	91	4.57	Very Valid
Language	71	85	90	4.50	Very Valid
Material	71	75	95	4.80	Very Valid
Average	62	72	92		Very Valid

The validation results from three experts yielded an average of 4.57 for the media expert, 4.50 for the language expert, and 4.80 for the language expert. All three expert validation results demonstrated highly valid averages, but all three experts still provided constructive comments and input for the e-LKPD being developed. The next stage was a one-to-one test, which aimed to verify the practicality of the e-LKPD being developed and to identify and mitigate potential errors. The questionnaire results for the three student respondents in the one-to-one test are presented in Table 4 below.

Table 4. Summary of one-to-one test results

Aspects	Average	Percentage Results (%)
Media Display	4.80	96
Ease of Use	4.50	90
Material Understanding	4.50	90
Motivation	4.46	89
Learning		18.26
Total		4.60
Average		91
Mean Percentage		Very Practical

Table 5. Summary of small group results

Name	Aspect			
	1	2	3	4
AZ	3.50	4	4	4.80
MKP	4.50	4.10	4.50	4
KJ	4.25	4.30	4.50	4
AR	4.80	4.40	4	4.60
KA	4.50	4	5	4.80
MF	5	4.40	5	4.40
RNA	4.25	4.40	4.50	4.40
ETA	4.50	4.70	5	4.80
Average/Aspect	4.40	4.30	4.60	4.50
Percentage (%)	88	86	92	90
Overall Average				4.40
Average percentage (%)				86.25
Category				Very Practical

The results of the one-to-one evaluation in Table 4 above yielded a percentage of 91%, categorized as very practical. Meanwhile, the results from the small group evaluation are presented in Table 5.

Learning motivation aspect, the practicality test, conducted through a small group test, yielded a percentage of 86.25%, categorized as very practical. Next, the field test conducted an effectiveness test. The results of this effectiveness test are presented in Table 6.

Table 6. Summary of pretest, posttest, and N-Gain averages

Pretest Average	Posttest Mean	N-Gain
42.50	84.75	0.72
Category		Tall

The table shows that the pretest average, which was initially 42.50, has changed to 84.75, and the N-Gain is 0.72, which is categorized as very high. This indicates that the developed Hypercontent E-LKPD is effective for use in learning.

Discussion

This research aims to develop an AI-based hypercontent e-LKPD (E-LKPD) for fifth-grade elementary school science learning. Validation results from media, language, and materials experts indicate that the developed product is highly valid. Practicality testing was conducted in three stages: one-on-one, small group, and field testing, directly involving students as the primary subjects. Data collection was conducted using a questionnaire analyzed using a Likert scale to quantitatively determine the level of practicality of the media. The development of this hypercontent e-LKPD refers to the Rowntree Model combined with Tessmer's formative evaluation. This model consists of three stages: planning, development, and evaluation, conducted systematically (Sarancic et al., 2024). This research aligns with findings, which stated by Alfirzan et al. (2024), that the model is practical and easy to follow in developing learning media. Tessmer's formative evaluation facilitates researchers in reviewing and revising the product based on feedback at each stage of development (Fahmi et al., 2021).

The involvement of experts in the validation process aims to ensure the quality and feasibility of the developed e-LKPD. This is supported by Lestari (2021), who stated that the combination of the Rowntree model and Tessmer evaluation is suitable for assessing the validity, practicality, and effectiveness of learning media. This e-LKPD was developed to facilitate students' deeper understanding of the material on Natural Phenomena and Its Changes. Hypercontent features such as video, animation, and interactivity are advantages in supporting 21st-century learning. Analysis of student needs indicates a high level of interest in technology-based learning, with 82% expressing interest and 80% expressing expectations for the e-LKPD. All students own smartphones and are accustomed to using them in their daily activities. Research (Afifah & Junaedi, 2024; Saputri et al., 2024), indicates that hypercontent-based LKPD can improve students' knowledge, skills, and active engagement in the learning process.

Meanwhile, Herlina (2019) emphasized that integrating YouTube videos into LKPD provides more concrete visualizations, thereby deepening conceptual understanding. Meanwhile, Usman et al. (2024) added that media such as E-LKPD Hypercontent is an important innovation to meet the needs of 21st-century learning. This product encourages active student participation and is tailored to their characteristics (Khaeruddin et al., 2022). This aligns with the opinion of Johan et al. (2022), who stated that E-LKPD Hypercontent can increase motivation due to its attractive and easy-to-understand illustrations and display (Aladin et al., 2024). This proves that this media is designed not only to convey material but also as an engaging and meaningful learning tool. In addition to students, teachers' needs were also considered in the development of this E-LKPD. The analysis results showed that the technical aspect achieved 94%, the pedagogical aspect 78%, and the cognitive aspect 72%.

This media is considered to help teachers deliver material more effectively and improve student learning outcomes (Widiasanti et al., 2023). Meanwhile, Firdaus et al. (2023) and Fanani et al. (2022) emphasized the importance of learning media that can explain concepts in detail and engagingly, in line with teachers' needs in the teaching process. Furthermore, expert validation results showed that the media aspect achieved an average score of 91.40%, language 90%, and material 95.2%, all in the very valid category. Improvements were made based on expert input, such as improvements to the display, sentence structure, and the addition of practice questions. These results support the findings of Alfianto & Heri (2024) that the developed e-LKPD met the very good criteria. Furthermore, Lim & Rasul (2022) stated that this media was not only appropriate in terms of content but also received positive feedback from users.

In the one-to-one practicality test, the media achieved an average score of 91%, categorized as very practical. Similar results were also found in the small group test, with an average score of 86.25%. Aspects assessed included display, ease of use, material comprehension, and learning motivation. Research by Scheel et al. (2022), indicates that this media is suitable for individual use and can enhance the comfort of

independent learning. Pretest and posttest results showed an increase in scores from 42.5 to 84.75%, with an N-Gain value of 0.72 (high category). These results demonstrate the effectiveness of Hypercontent E-LKPD in improving student learning outcomes. Madokala et al. (2025) confirmed that Hypercontent-based media is feasible and effective for use in science and science learning. Further research from Assegaf & Bonyah (2024) confirms that digital media can significantly improve conceptual understanding.

However, the development of Hypercontent E-LKPD has several limitations. For example, limited devices, such as school Chromebooks, do not support optimal use due to email and battery constraints. However, the principal's suggestion to use smartphones successfully overcomes these obstacles. Thus, this E-LKPD Hypercontent still has great potential as an effective, flexible, and appropriate learning medium for science learning in elementary schools.

Conclusion

This research successfully developed an AI-based Hypercontent E-LKPD for Science learning in fifth grade elementary schools. This E-LKPD was assessed as very appropriate by validation experts, students, and teachers and has been proven effective in helping improve student learning outcomes on the material Natural Appearances and Their Changes with a very practical category, and this E-LKPD is effective to use with an N-Gain score criterion of 0.72 with a very high category.

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