Development of Electronic Student Worksheet Based on Cooperative Learning in IPAS Subject for Grade V Elementary School Students

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Abstract: Low student participation in IPAS learning, limited instructional media, and reliance on printed materials at SD Kartika I-10 Padang have negatively affected students' understanding. This study aimed to develop an electronic student worksheet (E-LKPD) based on cooperative learning that meets the criteria of validity, practicality, and effectiveness for fifth-grade IPAS learning. The research applied a Research and Development (R&D) design using the ADDIE model, which includes Analyze, Design, Development, Implementation, and Evaluation. The subjects were 22 fifth-grade students. The development process involved analyzing needs, curriculum, and student characteristics, designing visual and content aspects of the E-LKPD, validating with media, material, and language experts, followed by product revision, implementation, and evaluation. Data were collected through expert validation sheets, teacher and student practicality questionnaires, and pretest-posttest. Results indicated high validity with an average score of 95%, while practicality was rated very practical by teachers (95%) and students (88%). Student learning outcomes improved significantly, with mean pretest and posttest scores of 56.59 and 90.45, respectively. The Wilcoxon test confirmed a significant difference (Z = -5.735, p < 0.05), reliability reached 0.80038 (reliable), and the N-Gain score was 0.79 (79.37%) in the high category. These findings conclude that the cooperative learning-based E-LKPD is valid, practical, and effective for enhancing IPAS learning in elementary schools.

Keywords: Cooperative learning; Electronic worksheet; Elementary school; IPAS; One-group pretest-posttest design

Introduction

Education plays a fundamental role in shaping human resources and fostering the progress of a nation. A high-quality education system does not merely emphasize academic achievement but also cultivates 21st-century competencies such as critical thinking, creativity, collaboration, and communication (Kain et al., 2024; Trilling et al., 2009; Wahyuni et al., 2025). In the current digital era, the integration of technology in learning is no longer optional but has become an essential strategy to enhance student engagement and comprehension (Anderson et al., 2011; Candrasiwi et al., 2023). In line with this, the Indonesian government has introduced the Merdeka Curriculum, which promotes learner-centered instruction, flexibility, and contextual learning. Within this curriculum, Natural and Social Sciences (IPAS) is a core subject at the elementary school level. IPAS is designed to equip students with scientific literacy, social awareness, and problem-solving skills that enable them to connect scientific concepts with real-

life phenomena (Luthfiyah et al., 2025; Saraiva et al., 2025).

Despite its importance, the implementation of IPAS in Indonesian elementary schools still faces significant challenges (Raja et al., 2025). Previous studies indicate that science and social studies learning at the basic education level is often teacher-centered, less interactive, and dominated by textbooks or printed media (Sirjon et al., 2023; Zahwa et al., 2022). The limited use of ICT-based learning resources further reduces student engagement and motivation. Teachers frequently rely on lectures, slides, or short videos, which are insufficient to stimulate active participation or address students' difficulties in understanding abstract concepts. Such conditions result in low participation, poor comprehension, and limited collaborative skills among students. This issue is also evident in SD Kartika I-10 Padang, where classroom observations revealed that students tend to remain passive, show minimal initiative to ask or answer questions, and struggle to follow group discussions effectively.

To overcome these obstacles, innovative learning resources are needed that can promote both cognitive and social engagement. One promising solution is the use of Electronic Student Worksheets (E-LKPD). Compared to conventional worksheets, E-LKPD allows the integration of multimedia elements such as images, animations, and interactive tasks, making learning materials more engaging and accessible (Choiroh et al., 2023; Puspita et al., 2021). Moreover, E-LKPD enables real-time feedback, flexible use, and supports independent as well as collaborative learning (Meydi et al., 2024; Purnawati et al., 2020). Parallel to this, the cooperative learning model offers a pedagogical approach that encourages active collaboration among students through group investigation, discussion, and problem-solving activities (Artawan, 2023; Damayanti et al., 2023; Johnson et al., 2021). Cooperative learning not only strengthens academic achievement but also nurtures interpersonal and social skills, which are essential for elementary school students (Jamaluddin et al., 2018; Peña-Ayala, 2021; Tadesse et al., 2020).

Several previous studies have reported the benefits of using either E-LKPD or cooperative learning separately in improving learning outcomes However, research that combines both—integrating E-LKPD with cooperative learning in IPAS at the elementary level—remains limited. This gap indicates the need for further empirical evidence on how digital worksheets designed with cooperative learning principles can enhance validity, practicality, and effectiveness in the classroom. Addressing this gap is particularly urgent in the context of schools such as SD Kartika I-10 Padang, where low participation and the dominance of print-based media hinder students' learning experiences.

Therefore, this study aims to develop an Electronic Student Worksheet (E-LKPD) based on cooperative learning for IPAS subject in grade V. Specifically, the research seeks to: (1) determine the validity of the developed E-LKPD through expert evaluation, (2) assess its practicality from the perspective of teachers and students, and (3) evaluate its effectiveness using a one-group pretest-posttest design. The results of this study are expected to contribute theoretically by expanding the literature on the integration of technology and cooperative pedagogy, and practically by providing an innovative learning resource that can be adopted to enhance elementary science and social studies learning in line with the objectives of the Merdeka Curriculum (Ningrum, 2022).

Method

This research employed a Research and Development (R&D) approach with the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) to produce an electronic student worksheet (E-LKPD) based on cooperative learning for the Science and Social Studies (IPAS) subject in fifth grade and to test its validity, practicality, and effectiveness (Lestari et al., 2023; Sugiyono, 2014). The participants in this study were 22 fifth-grade students of SD Kartika I-10 Padang, selected using purposive sampling.

In the analysis stage, several activities were carried out, including needs analysis, curriculum analysis, concept analysis, and student analysis (Saeidnia et al., 2022). Needs analysis was conducted through classroom observations and structured interviews with one IPAS teacher to identify problems in learning, especially related to student participation and the use of media. Curriculum analysis was performed to ensure alignment with the Merdeka Curriculum implemented at SD Kartika I-10, while concept analysis was directed at outlining relevant subtopics of the respiratory system. Student analysis was conducted through a questionnaire distributed to 22 students, consisting of 15 items related to learning motivation, media preferences, and prior knowledge. The data were analyzed descriptively to identify student characteristics and learning difficulties, which were later used to design the E-LKPD (Sugiyono, 2019).

The design stage focused on preparing the learning framework. This included the development of 20 multiple-choice test items aligned with learning indicators to be used in pretest and posttest, the selection of learning media in the form of an electronic worksheet based on cooperative learning, and the arrangement of activity syntax following cooperative learning principles. The media format was designed using the Liveworksheet platform, enriched with images, videos,

and animations to increase student engagement (Mayer, 2024; Ulyatin et al., 2023). Additionally, instruments for evaluation were prepared, including validation sheets for content, media, and language experts, practicality questionnaires for teachers and students using a four-point Likert scale, and pretest-posttest instruments for effectiveness measurement (Vandevelde et al., 2025).

In the development stage, the E-LKPD product was created using Canva for visual design, Microsoft Word for content preparation, and Liveworksheet for interactive elements. The draft product was then validated by three experts (material, media, and language). Each expert assessed the product using a four-point Likert scale, and the results were analyzed using Aiken's V, where a score above 0.80 indicates high validity. Suggestions from the validators were incorporated into revisions before classroom implementation (Pramita et al., 2023).

The implementation stage applied a quasi-experimental design with a one-group pretest-posttest design, which involved administering the pretest, conducting learning using the E-LKPD in cooperative groups, and administering the posttest afterward. At the end of the implementation, practicality questionnaires were distributed to both the teacher and students to evaluate usability and feasibility (Kong et al., 2024; Sirjon et al., 2023).

The evaluation stage aimed to assess validity, practicality, and effectiveness. The validity results from expert judgment were analyzed with Aiken's V. Practicality was evaluated through descriptive statistical analysis of the teacher and student questionnaires, while the reliability of the practicality instruments was tested using Cronbach's Alpha, with $\alpha > 0.70$ considered acceptable. Effectiveness was measured through several analyses: the Shapiro–Wilk test was used to test the normality of pretest and posttest data; if the data were not normally distributed, the Wilcoxon Signed-Rank test was employed to examine the significance of score differences; and the Normalized Gain (N-Gain) was used to measure the magnitude of improvement in student learning outcomes, categorized into low (<0.3), medium (0.3–0.7), and high (>0.7) (Sukarelawan et al., 2019).

Finally, it should be noted that this research has a methodological limitation, namely the use of only one group without a control group, which limits the comparison of outcomes with other learning models. This design was chosen due to time and resource constraints. Future research is recommended to include a control group to strengthen the generalizability and causal claims of the findings.

Table 1. ADDIE Development Model Steps

Teaching and Learning of IPAS in Grade V Elementary School
Classroom Conditions:
1. Low student participation in learning activities.
2. Students easily lose focus when the teacher explains.
3. Students have difficulty understanding abstract concepts.
4. Students struggle to comprehend the material and require repeated explanations.
5. Students get bored easily during lessons.
6. Teachers have not yet optimized the use of technology in learning.
Analysis
Needs analysis, IPAS curriculum analysis for Grade V Phase C, and analysis of students' characteristics.
Design
Creating the cover, layout, and graphic design, as well as preparing content using Canva.
Development
Validation testing by media experts, material experts, and language experts.   → Revision
Implementation
The use of Electronic Student Worksheet (E-LKPD) based on cooperative learning for the IPAS subject in Grade V Elementary School.   → Practicality testing   → Effectiveness testing   → Revision
Evaluation
1. Analyzing the results of validity and practicality tests.   2. Analyzing students' learning outcomes.
Result
An Electronic Student Worksheet (E-LKPD) that is valid, practical, and effective.

Result and Discussion

This study aims to develop an electronic learning material in the form of E-LKPD based on cooperative learning for the subject of Science and Social Studies (IPAS) for Grade V students at Kartika 1-10 Elementary School in Padang. The development process of this learning material follows the ADDIE model, which includes the stages of analysis, design, development, implementation, and evaluation (Branch, 2009).

The analysis stage begins with the identification of student needs, the curriculum, and the learning materials. Observations and interviews with IPAS teachers were conducted to identify issues in the learning process, while curriculum analysis ensured that the material taught was aligned with the Merdeka Curriculum implemented at Kartika 1.10 Private Elementary School. Concept analysis was carried out by compiling relevant material on the topic of the respiratory system, and student analysis was conducted through interviews with teachers and the distribution of questionnaires to students to understand their

characteristics and difficulties in learning. This stage aimed to produce clear learning objectives, which were then used in the design of the learning media (Sugiyono, 2019).

In the design stage, the E-LKPD media was designed using the cooperative learning approach, specifically Group Investigation (GI), which aims to encourage collaboration and social skills among students (Tian et al., 2024). For the design process, the researcher used Canva for visual presentation and Liveworksheets for interactivity (Nurafriani et al., 2023; Prastika et al., 2021). This design aimed to provide a more enjoyable learning experience and encourage students to actively engage in group discussions, explore information, and present their findings. The results from this design show that the developed learning materials were visually appealing and facilitated learning in a more dynamic manner.
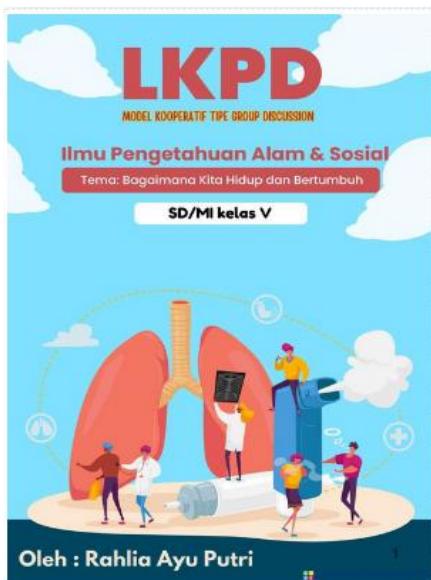
Figure 1. Electronic worksheet cover

Figure 2. Electronic worksheet introduction

Figure 3. Assigning discussion tasks

Figure 4. Electronic worksheet group discussion

In the development stage, the cooperative learning-based E-LKPD product was revised based on feedback from media, material, and language experts. The validity test results showed that the E-LKPD had a very high level of feasibility. Validation by media experts gave a score of 90%, by material experts 96%, and by language experts 100%, with an overall average score of 95%, indicating that the product was highly suitable for use in learning (Trianto, 2014). Therefore, the E-LKPD was deemed to meet the necessary standards in terms of design, content, and language to support an effective learning process.

The implementation stage was carried out over two meetings with Grade V students at Kartika 1-10 Private Elementary School, using pretests and posttests to measure student learning outcomes before and after using the E-LKPD. The practicality survey results

showed that the E-LKPD achieved very high practicality scores, with an average response score of 95% from teachers and 88% from students, indicating that the product was easy to use and effective in the learning process. Effectiveness testing conducted by comparing pretest and posttest scores showed a significant improvement in student learning outcomes. The average pretest score was 56.59, while the average posttest score increased to 90.45, with an N-Gain score of 0.79, categorized as high, indicating that the E-LKPD was effective in improving student learning outcomes (Hake, 1998).
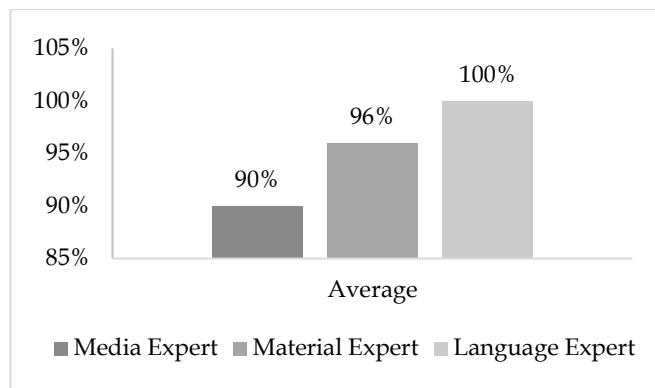

Figure 5. Validation results summary chart
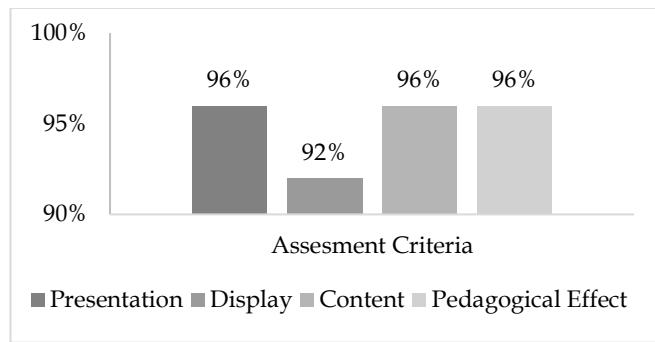
**Figure 6**. Recapitulation of teacher practicality
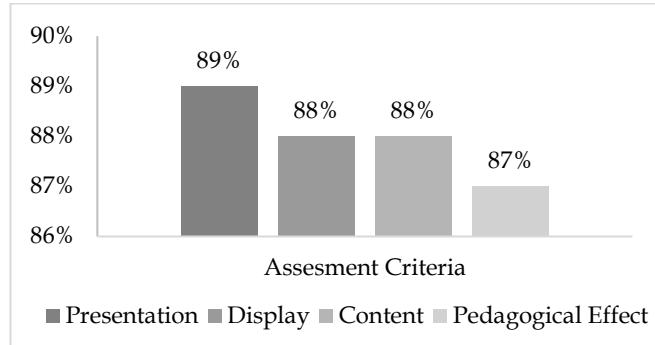
Figure 7. Recapitulation of student practicality

Statistical tests using the Wilcoxon test for pretest and posttest data showed a very small significance value (<0.001), indicating a significant difference in learning outcomes before and after using this learning media

(Sugiyono, 2014). These results confirm that the use of cooperative learning-based E-LKPD can enhance students' understanding of the respiratory system material.

In addition to showing significant differences between pretest and posttest results, further analysis also highlights the strong impact of using the cooperative learning-based E-LKPD. The N-Gain value of 0.79, which falls into the high category (Hake, 1998), indicates that the improvement in student learning outcomes was not only statistically significant but also had substantial effects on students' conceptual understanding. This finding reinforces the evidence that technology-based, interactive media can provide deeper learning experiences compared to conventional teaching methods.

These results are also consistent with previous research on the development of electronic learning materials. For instance, Nurafriani et al. (2023) found that the use of technology-based e-modules increased student engagement in learning, while Prastika et al. (2021) emphasized the importance of integrating interactive elements to encourage student participation. Compared to these studies, the present research provides novelty by integrating the Group Investigation (GI) type of cooperative learning into the E-LKPD, highlighting collaboration, discussion, and independent learning as the core learning processes.

Table 2. Recapitulation of Validation Result

Type of Validation	Evaluation Score	Category
Media Expert	90%	Very Valid
Material Expert	96%	Very Valid
Language Expert	100%	Very Valid
Average	95%	Very Valid

Theoretically, this research contributes to the development of cooperative learning models, especially the GI type. This approach proved effective in encouraging students to work together, share responsibilities, and communicate their findings, aligning with the cooperative learning theory outlined by Trianto (2014). The practical implications are also important for teachers, as the findings suggest that technology-based E-LKPD can serve as an alternative to conventional methods, helping teachers achieve learning goals that emphasize collaboration and 21st-century competencies.

Furthermore, this study aligns with the implementation of the Merdeka Curriculum, which emphasizes student agency, collaboration, and digital literacy. The developed E-LKPD not only functioned as a medium for delivering content but also as a tool for building independent learning skills, critical thinking, and digital literacy (Darmansyah, 2021). This

demonstrates that E-LKPD can support educational policies that promote innovation and the integration of technology in learning.

Although the research results show significant success, this study also has some limitations. The constraints of time, resources, and technology access limited the scope of the research, which was only conducted in one school with Grade V students. Additionally, the developed material focused only on one topic (the respiratory system), so it has not yet been applied to other IPAS topics. The limitations in facilities and internet connectivity also affected the smooth use of electronic media during the learning process. Therefore, further research with a wider sample and more diverse material is necessary to test the generalizability of these results in various educational contexts.

Overall, the research results indicate that the development of the cooperative learning-based E-LKPD using the GI type approach is highly effective in improving students' learning outcomes on the respiratory system material. The use of interactive and technology-based learning media not only makes learning more engaging but also increases active student participation, aligning with the principles of 21st-century learning, which emphasize collaboration, independence, and digital literacy (Bentri et al., 2022; Darmansyah, 2021; Hidayati et al., 2020).

Conclusion

The research and development of an electronic learning material in the form of E-LKPD based on cooperative learning for Grade V Elementary School using the ADDIE model has proven to be valid, practical, and effective for classroom implementation. The validation results from media, material, and language experts obtained an average score of 95%, categorized as "very feasible," while practicality tests showed high practicality with scores of 95% from teachers and 88% from students. In terms of effectiveness, student learning outcomes improved significantly, with the average score increasing from 56.59 to 90.45 and an N-Gain of 0.79 (high category), demonstrating that the E-LKPD effectively enhanced students' understanding of the respiratory system material in the IPAS subject. Theoretically, this research supports constructivist theory by highlighting the role of collaborative learning in improving outcomes through active engagement, while practically, it offers teachers an innovative digital alternative aligned with 21st-century learning and the Merdeka Curriculum. These findings are expected to serve as a reference for schools, teachers, and education stakeholders in enhancing learning quality through digitalized teaching materials, while further research with broader samples and more

comprehensive designs, including control groups, is recommended to strengthen the generalizability of the results.

Author Contributions
Conceptualization, methodology, R, A, A, R; validation, R, S, A; form analysis, investigation, data curation, wirting-original draft preparation, R; writing-review and editing, R, A, A, R. All Authors have read and agreed to published version of the manuscript.

Conflicts of Interest
The authors declare no conflict of interest.

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