



PBL-Oriented E-LKPD Assisted by Liveworksheet for Improving Cognitive Outcomes in Fifth-Grade IPAS Learning

Niky Luthfi Pratiwi^{1*}, Endang Widi Winarni², Abdul Muktadir³, Osa Juarsa⁴,
Neza Agusdianita⁵, Hakimee Yasing⁶

^{1,2,3,4,5,6}Universitas Bengkulu, Bengkulu, Indonesia



DOI : <https://doi.org/10.46245/ijorer.v7i4.1405>

Sections Info

Article history:

Submitted: February 06, 2026

Final Revised: May 20, 2026

Accepted: Juny 06, 2026

Published: July 30, 2026

Keywords:

E-LKPD; ADDIE Model;

Project Based Learning (PBL)

Live Worksheet; Cognitive

Learning Outcomes



ABSTRACT

This study aims to develop an electronic student worksheet (E-LKPD) based on the Project-Based Learning (PBL) model assisted by Liveworksheet to improve the cognitive learning outcomes of fifth-grade elementary school students. The research employed a Research and Development (R&D) design using the ADDIE development model. The research subjects were fifth-grade students at SD Negeri 22 Rejang Lebong, with Class VA serving as the trial class and Class VB as the experimental class. Both qualitative and quantitative data were collected through observation, interviews, questionnaires, tests, and documentation. Data analysis involved qualitative and quantitative techniques. The findings show that: (a) the E-LKPD validation results by material, language, and graphic experts ranged from 0.67 to 1.00, indicating valid to highly valid categories; (b) the test instrument validation results by material, language, and construction experts ranged from 0.72 to 0.90, also categorized as valid to highly valid; and (c) teacher and student responses were highly positive, with teacher response percentages ranging from 67% to 100% and student responses from 87% to 93%. The average N-gain score of the experimental class was 0.8 (80.9%), indicating a high level of effectiveness. Therefore, the PBL-based E-LKPD assisted by Liveworksheet is declared valid, feasible, and effective for use as an instructional material to improve students' cognitive learning outcomes in the ecosystem topic, particularly the food-chain subtopic.

INTRODUCTION

In an era of globalization and rapid advancement in information technology, educational systems have become increasingly rigorous and complex. According to Ester Reni Sawitri (2023, p. 15), learning outcomes consist of three dimensions: cognitive, affective, and psychomotor, all of which are attained through the learning process. These learning outcomes can be measured based on learning achievements. Learning achievement refers to the expected competencies students should acquire after completing the learning process, primarily encompassing the cognitive or knowledge domain (Ma'rufi et al., 2025, p. 77).

One of the learning achievements outlined in BSKAP (2025) that can be measured is the ability to analyze the relationships between biotic and abiotic components and their influence on ecosystems, which is part of the IPAS curriculum for Grade V students in Phase C. IPAS learning in elementary schools particularly for fifth-grade students is characterized by the requirement to analyze the interconnectedness of biotic and abiotic components and their effects on ecosystems, as stated in BSKAP (2025). At the createl stage, students are expected to solve, analyze, and evaluate problems (Hanan et al., 2025).

However, in practice, low cognitive learning outcomes among fifth-grade students in IPAS learning are still evident. According to Bloom, as cited in Ali M.K. et al. (2025),

the cognitive domain comprises six levels: (1) Knowledge, (2) Comprehension, (3) Application, (4) Analysis, (5) Evaluation, and (6) Creation.

Hayati et al. (2025, p. 4) define teaching materials as forms of content, information, or media used by educators to support the learning process. Teaching materials exist in various forms. Sugiarni (2022, p. 20) categorizes them into: (1) visual materials, such as books, modules, student worksheets, and brochures; (2) audio materials, such as cassettes, radio, and records; (3) audiovisual materials, such as films; and (4) interactive multimedia materials, such as learning CDs and web-based learning materials. Based on these classifications, one form of teaching material that can be used by educators is the student worksheet (LKPD).

Technological integration in education, particularly at the elementary level, has grown rapidly. A recent innovation is the use of electronic student worksheets (E-LKPD). The advantages of E-LKPD include facilitating the teaching process, reducing educators' workload, and promoting active student engagement (Suryandari et al., 2023, pp. 701–702). Effective implementation of E-LKPD requires an appropriate learning model, one of which is Project-Based Learning (PBL). According to Ermaniatu Nyihana (2021, pp. 10–11), PBL encourages educators and learners to develop questions that allow students to engage meaningfully with the content. Ayuningrum and Saputra (2024) conclude that the consistent and structured application of PBL supports students in developing skills necessary to meet the challenges of 21st-century technological advancement. Nevertheless, PBL also has weaknesses, such as requiring extended time, which may hinder students' understanding of certain topics (Munir et al., 2023). This limitation can be addressed by incorporating instructional media to create a more active and interactive learning environment.

Digital learning media or e-media refers to media based on electronic devices (Tumbel Ferny Margo & Kawuwung Femmy Roosje, 2023, p. 132). In line with this, Saparuddin (2022) states that Liveworksheet facilitates interactive learning. Liveworksheet is flexible for both online and face-to-face learning, as it allows the integration of videos, images, and audio (Julianti et al., 2025). For educators, Liveworksheet simplifies the distribution of assignments, saves time, and offers customizable and engaging templates. For students, it enables them to complete and submit worksheets conveniently through mobile phones or laptops (Iriani et al., 2023).

Currently, cognitive learning outcomes among elementary school students remain low. Based on observations and interviews conducted with teachers at SD Negeri 22 Rejang Lebong in August 2025, it was found that fifth-grade students demonstrated low cognitive outcomes in IPAS learning. Out of 21 students, only 12 showed good cognitive achievement, while 9 displayed low achievement. IPAS learning had not been implemented optimally; teaching remained teacher-centered, relying heavily on lectures and minimally motivating assignments. The use of interactive LKPD was absent, and existing school facilities were underutilized. Students expressed that they enjoyed IPAS lessons because the content is closely related to daily life, such as animals and plants in their environment. However, when asked about food chains in ecosystems, only a few students were able to respond correctly. The fifth-grade teacher noted that while printed LKPD had been used previously, it required excessive paper consumption. The teacher also reported limited knowledge in developing electronic worksheets.

Based on the issues identified through observations and interviews, innovative learning solutions are needed to improve students' cognitive learning outcomes in IPAS

learning. The Project-Based Learning (PBL) model, which emphasizes student-centered and real-world learning experiences, can be integrated with electronic student worksheets (E-LKPD) to support more interactive and meaningful learning activities. One suitable platform for developing interactive E-LKPD is Liveworksheet, which enables the integration of multimedia elements and flexible learning access. Previous studies have shown that PBL-based E-LKPD assisted by Liveworksheet can improve science learning outcomes and support active student participation. Therefore, this study aims to develop a PBL-oriented E-LKPD assisted by Liveworksheet and examine its validity, feasibility, and effectiveness in improving the cognitive learning outcomes of fifth-grade elementary school students in IPAS learning, particularly on the ecosystem topic.

RESEARCH METHOD

The research employed a Research and Development (R&D) design. The purpose of development research is to generate or refine existing scientific knowledge (Winarni, 2018, p. 9). The development model adopted in this study was ADDIE, which can be applied to various forms of educational product development such as instructional models, learning strategies, methods, media, and teaching materials (Winarni, 2018, p. 263). ADDIE is an acronym referring to the five core processes of instructional system development—Analyze, Design, Development, Implementation, and Evaluation. This model facilitates continuous evaluation and revision at each stage, ensuring that the resulting product is both valid and reliable. Developed by Dick and Carey (cited in Winarni, 2018, p. 263), ADDIE is simple in concept yet systematic in its five-stage structure, which covers the entire instructional development cycle. This study followed the ADDIE developmental procedures. The first stage in this study was the Analyze phase, which consisted of five forms of analysis: curriculum analysis, teaching module analysis, worksheet (LKPD) analysis, needs analysis of teachers and students, and analysis of student characteristics.

Curriculum analysis involved examining the curriculum currently in use (Winarni, 2018, p. 258). The researcher selected the Grade V IPAS content, Chapter *Harmony in Ecosystems*, Topic A *Predation (Eating and Being Eaten)*. Elements analyzed included the scope of science content, IPAS learning objectives, general competency components, learning outcomes, learning objectives, and learning progression. In the teaching module analysis, the researcher reviewed the module used by the classroom teacher for the same chapter and topic. The analysis focused on general information, learning outcomes and objectives, instructional design, and session details.

LKPD analysis examined worksheets previously used by teachers during instruction. This analysis aimed to identify discrepancies between ideal learning conditions and actual classroom implementation, particularly regarding the use of teaching materials such as LKPDs.

Needs analysis was conducted to collect information regarding instructional gaps and determine priority issues to be addressed (Winarni, 2018, p. 258). Interviews and observations with the Grade V teacher were carried out concerning 14 indicators, including teacher challenges in instruction, students' understanding and engagement, frequency of group learning, knowledge and application of instructional models, teacher mastery of multimedia tools, students' need for multimedia-based PBL, and evaluation

methods for cognitive outcomes. A student needs questionnaire consisting of 14 questions representing 11 indicators was also administered to capture students' learning challenges, interest in learning, perceived difficulty of the content, preferred learning methods, and perceptions of technology in learning.

Analysis of student characteristics was conducted through direct observation and student questionnaires related to the IPAS learning, particularly Chapter *Harmony in Ecosystems*, Topic *Eating and Being Eaten*. This analysis aimed to determine students' readiness, abilities, needs, and responses. Following the analysis phase, the study proceeded to the **Design** stage. The researcher designed an E-LKPD incorporating PBL on the topic of predation, supported by Liveworksheet, with a diorama project on food webs as the culminating task. The researcher selected Grade V students of SD Negeri 22 Rejang Lebong and used Canva as the design platform for both the LKPD and Liveworksheet.

Material analysis and structuring were aligned with the Phase C Learning Outcomes for Grade V. The E-LKPD was developed using language appropriate for Phase C learners and with careful attention to the components of an effective LKPD. The title page contained the main topic, grade level, and semester. Subsequent pages included instructions for using the PBL-based E-LKPD supported by Liveworksheet, integrating interactive multimedia elements such as images and text. The learning indicators page contained learning outcomes relevant to Chapter *Harmony in Ecosystems*. A concept map page presenting the chapter title, topic, and key materials was designed using text and images. Contextual knowledge was presented concisely and visually. Tasks and procedures followed the syntax of Project-Based Learning: (1) Start with an essential question, (2) Design a project plan, (3) Create a schedule, (4) Monitor students and project progress, (5) Assess the outcomes, and (6) Evaluate the learning experience.

The Development stage was conducted after the initial E-LKPD design was completed. Validation was carried out by experts (Winarni, 2018, p. 260). The product underwent expert validation in three domains: content, language, and graphics. Expert assessments informed product revisions to refine the final version. Validation continued until the LKPD was deemed feasible and effective for classroom implementation. Validation analysis also aimed to determine the reliability of the E-LKPD using data from experts. Six validators participated: two content experts, two language experts, and two graphic design experts.

The validated PBL-based E-LKPD supported by Liveworksheet was implemented with Grade V-A students of SD Negeri 22 Rejang Lebong. After the trial implementation, teachers and students completed user-response questionnaires. A cognitive learning test was also administered to evaluate the test instrument.

An effectiveness evaluation was conducted using a one-group experimental design with Grade V-B students and measured through pretest and posttest outcomes. The research subjects consisted of Grade V-A (20 students: 10 boys, 10 girls) as the trial group and Grade V-B (20 students: 9 boys, 11 girls) as the experimental group. The study was conducted during the first semester of the 2025/2026 academic year.

Data were collected through observation, interviews, questionnaires, tests, and documentation. Data analysis employed qualitative analysis, quantitative analysis, and effectiveness analysis based on test results.

Qualitative analysis was used to process interview results, expert feedback, and questionnaire responses from teachers and students. These findings guided the revision and refinement of the E-LKPD. Quantitative analysis included instrument validation, analysis of teacher and student responses, and empirical test validation. Instrument validity used Aiken's V:

$$V = \frac{\sum s}{n(c - 1)}$$

s = r - l₀

r = score assigned by an expert

l₀ = lowest validity rating

c = highest validity rating n = number of experts

with interpretation: V > 0.80 = very valid; 0.40–0.80 = moderate; 0–0.40 = low (Wasidi, 2020, p. 61).

Reliability was measured using the Kappa coefficient through SPSS Version 25, along with inter-rater agreement percentages. Agreement levels followed McHugh (2012). Teacher and student response data were analyzed using:

$$User\ response = \frac{Tse}{Tsh} \times 100$$

Tse = Total number of positive responses

Tsh = Total number of students who completed the questionnaire

Categories: 75–100% = very interesting; 50–74% = interesting; 25–49% = fairly interesting; 0–24% = less interesting.

Empirical item validity used the product moment correlation:

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{[\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}}$$

r_{xy} = item validity coefficient

$\sum XY$ = sum of cross-products of X and Y

$\sum X$ = total item scores

$\sum Y$ = total test scores

N = sample size

Validity interpretation followed Winarni (2018):

0.80–1.00 = very high; 0.60–0.79 = high; 0.40–0.59 = moderate; 0.20–0.39 = low; 0.00–0.19 = invalid.

Reliability was measured using:

$$r_{11} = \left[\frac{k}{k - 1} \right] \left[1 - \frac{\sum \sigma_b^2}{\sigma_t^2} \right]$$

r₁₁ = reliability coefficient

k = number of items

$\sum \sigma_b^2$ = total item variance

σ_t^2 = total test variance

The instrument was considered reliable if r₁₁ > r-table, and unreliable if r₁₁ < r-table.

Item difficulty (P) was calculated as:

$$p = \frac{B}{JS}$$

P = difficulty index
 B = number of students answering correctly
 JS = total number of test-takers Interpretation criteria were:
 0.00–0.30 = difficult; 0.31–0.70 = moderate; 0.71–1.00 = easy (Winarni, 2018, p. 137).
 Discrimination index (DP):

$$DP = \frac{JB_A}{J_A} - \frac{JB_B}{J_R}$$

J = total test-takers
 J_A = number in upper group
 J_B = number in lower group
 JB_A = number of upper-group students answering correctly
 JB_B = number of lower-group students answering correctly
 Interpretation criteria were: 0.00–0.20 = poor; 0.21–0.40 = fair; 0.41–0.70 = good; 0.71–1.0 = excellent (Winarni, 2018, p. 138).

Effectiveness was determined using the normalized gain (N-Gain):

$$g = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}}$$

Interpretation:
 g > 0.7 = high effectiveness; 0.3 < g ≤ 0.7 = moderate; 0 < g ≤ 0.3 = low; g ≤ 0 = ineffective (Yuwono, 2020).

RESULTS AND DISCUSSION

Results

This development research commenced with the analysis (Analyze) phase, which consisted of three components: curriculum analysis, needs analysis, and learner characteristics analysis. The curriculum analysis was conducted by examining the curriculum implemented at the school, namely the Kurikulum Merdeka. The researcher selected instructional content from the IPAS subject for Grade V (Phase C) of primary school, specifically Chapter II: Harmony in Ecosystems, focusing on the topic Predator-Prey Relationships, which includes food chains, food webs, and the roles of components within an ecosystem. The results of the curriculum analysis are presented in the following section:

Table 1. Result of Curriculum Analysis

Analyzed Aspect	Description
Scope of Science	The topic <i>Predator-Prey Relationships</i> with a diorama project on food webs falls under the scope of Science, which includes simple observation, identification of scientific questions, simple experimentation, data processing, reflection, and communication of investigation results.
IPAS Objectives	According to the Ministry of Education and Culture Regulation (Permendikbud) No. 12 of 2025, IPAS learning has six objectives, divided into Science (IPA) and Social Studies (IPS) objectives. The Science objectives are reflected in Points 1, 2, and 3: 1. Developing knowledge and conceptual understanding in IPAS and applying them in daily life. 2. Developing process skills to identify, formulate, and solve problems through concrete actions.

Analyzed Aspect	Description
Core Competency Component	3. Actively participating in preserving, maintaining, and conserving the natural environment as well as managing natural resources wisely. Based on the IPAS content, which includes understanding facts, concepts, principles, laws, theories, and models related to living organisms and their environments, the six Science Process Skills (KPS) for Phase C (Grade V) outlined in Permendikbud No. 12 of 2025 align with the topic Predator-Prey Relationships in IPAS Phase C.
Learning Outcomes (CP)	Students analyze the relationships between biotic and abiotic components and their influence on ecosystems.
Learning Objectives (TP)	1. Through video observation, students accurately identify predator-prey processes (C3). 2. Through video observation, students analyze the roles of each component in food chains and food webs (C4). 3. Through visual images, students compare food chains and food webs in ecosystems (C5). 4. Through video observation, students construct a food-web diorama carefully (C6). 5. Through project-based activities, students create a food-web diorama accurately (P5).
Learning Objective Flow (ATP)	1. Students identify predator-prey processes. 2. Students analyze the roles of components in food chains and food webs. 3. Students compare differences between food chains and food webs in ecosystems. 4. Students draw conclusions regarding the differences between food chains and food webs. 5. Students construct a food-web diorama.

The analysis of the teaching module aims to identify the strengths and weaknesses of the instructional materials used in the Grade V IPAS learning unit, Chapter *Harmony in Ecosystems*, on the topic *Predator-Prey Relationships*. The results of the teaching module analysis are presented in the following table:

Table 2. *Results of Teaching Module Analysis*

Observed Aspect	Complete	Incomplete
General Information	√	-
Learning Outcomes and Learning Objectivities	-	√
Module Usage Design	-	√
Meeting Details	-	√

Based on the results of the teaching module analysis, a subsequent evaluation was conducted on the student worksheets (LKPD) used by both teachers and students in Grade V of primary school. This analysis aimed to determine the extent to which the existing LKPD supported the effectiveness of the teaching module and contributed to improving learning quality. The available LKPD were found to be conventional and non-interactive, consisting primarily of printed worksheets focused on practice questions. Such materials provide limited opportunities for exploration, collaboration, or project-based learning. Furthermore, the LKPD currently in use did not foster enthusiastic or active participation in group work.

Following this, the researcher conducted a needs analysis. The needs analysis was carried out with teachers and Grade V students at SD Negeri 22 Rejang Lebong to gain insight into the ongoing learning process in the classroom. This analysis involved

two stages: (1) interviews with the homeroom teacher, specifically the Grade V teacher responsible for IPAS instruction, and (2) the distribution of questionnaires to ten students regarding their use of LKPD, the learning model implemented in class, the instructional media used by the teacher, and how these elements influenced their understanding. Based on the interview results and student questionnaire responses, the researcher concluded that IPAS learning still faces several challenges, including students' low conceptual understanding and teachers' difficulties in explaining abstract IPAS concepts, such as predator-prey relationships and the roles of organisms in an ecosystem. Teachers also reported that LKPD-integrated group work was rarely implemented due to time constraints and limited knowledge of how to apply such approaches. Insufficient knowledge regarding the use of learning models, LKPD, and interactive multimedia has contributed to a learning atmosphere that tends to feel monotonous and less engaging. Questionnaire results further revealed that students showed an interest in multimedia-based learning, suggesting that multimedia integration has the potential to increase students' motivation and comprehension.

The final stage of the analysis involved examining learner characteristics. Effective learning strategies and methods must align with students' characteristics so that teachers can design learning experiences that are engaging, effective, and relevant to their needs and levels of understanding. In this study, the analysis of learner characteristics was carried out through classroom observations and student questionnaires related to the IPAS learning process. The findings indicated that students preferred learning activities involving multimedia and collaborative group work. These results suggest that learning approaches should be contextually relevant and aligned with students' daily experiences. One strategy that may support these needs is the development of technology-integrated student worksheets, resulting in an electronic LKPD (E-LKPD) designed to be visually appealing and capable of enhancing students' motivation and interest in the subject matter.

Based on the analytical findings, the researcher proceeded to design an E-LKPD grounded in the Project-Based Learning model and supported by Liveworksheet. The goal was to develop an E-LKPD that is engaging and tailored to the needs of Grade V learners. The components of the E-LKPD were aligned with the characteristics of Grade V students in Phase C and comprised 13 pages excluding the cover page. The title section of the LKPD includes the main topic, grade level, and semester, as shown in the following illustration.

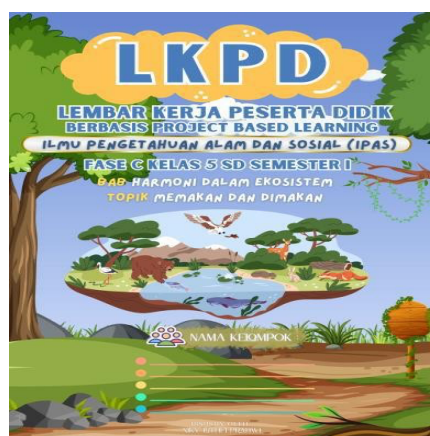


Figure 1. LKPD's Title

The instructions for using the E-LKPD, which is based on the Project-Based Learning model and supported by Liveworksheet, are integrated with interactive multimedia components such as images used as backgrounds and text. These instructions are presented on the following page, page (i), with the design shown below:



Figure 2. Instruction for Use

The learning indicator sheet contains the learning outcomes aligned with Phase C of Grade V for the IPAS unit Harmony in Ecosystems, specifically the topic Predator-Prey Relationships. It includes both the formulated learning objectives and the sequence of learning objectives that students are expected to achieve after completing the learning process using the multimedia-integrated E-LKPD. The following figure presents the display of the learning indicator sheet:

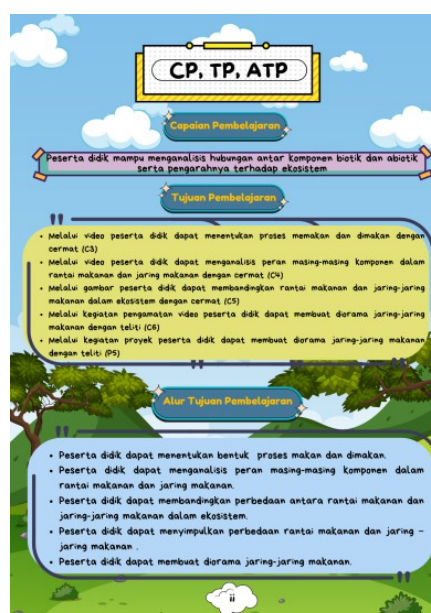


Figure 3. Learning Indicators

Furthermore, a page is provided containing a diagram or concept map that outlines the chapter title, topic, and learning content presented in the E-LKPD. This concept map integrates interactive multimedia elements, including text and images used as the background. The following figure illustrates the material concept map:



Figure 4. Materials Concept Map

The additional information sheet included in the E-LKPD appears in Assignment 2, which contains the tools and materials as well as the procedures for creating a food-web diorama. This section incorporates interactive multimedia components, including text and images used as the background. The following figure presents the display of the additional information sheet in the E-LKPD:

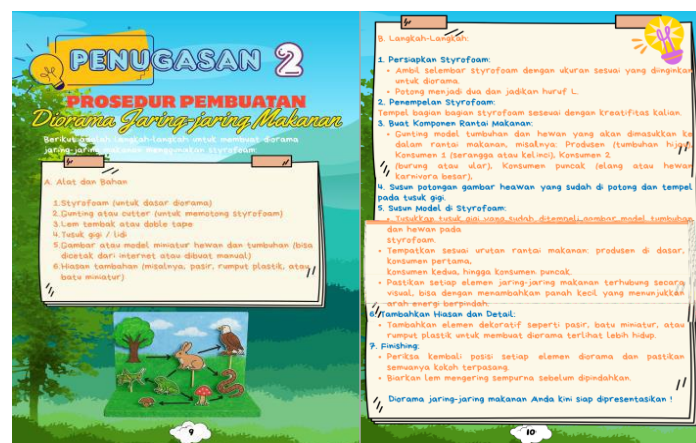


Figure 5. Additional Information

Contextual knowledge is presented briefly and accompanied by illustrations relevant to the material discussed, namely food chains, food webs, and the roles of each component. The display is presented as follows:

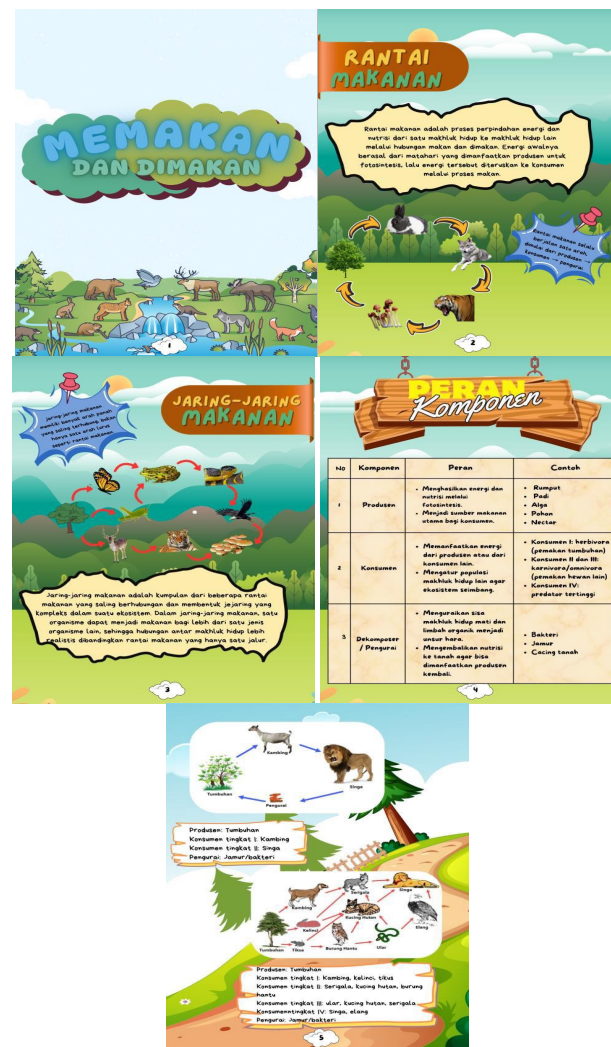


Figure 6. Contextual Knowledge

The tasks and procedural steps are aligned with the syntax of the Project-Based Learning model. In the first syntax sheet, an illustration of an ecosystem is presented along with guiding questions related to how living organisms survive. The following figure displays the first syntax of the Project-Based Learning model:



Figure 7. Basic Question Determination Syntax

In the second syntax sheet, several guiding questions are provided to assist students in designing a food-web diorama project. The following figure presents the second syntax of the Project-Based Learning model:



Figure 8. Designing Project Planning

In the third syntax sheet, students are assigned to work collaboratively in groups to develop a schedule and distribute tasks for the construction of the food-web diorama project. The following figure illustrates the third syntax of the Project-Based Learning model:



Figure 9. Creating Schedule Syntax

In the fourth syntax sheet, the content is preceded by an additional information page outlining the tools, materials, and procedures for creating the food-web diorama. Following this, students are assigned a task to present the food-web diorama project they

have created. The following figure illustrates the introductory assignment and the fourth syntax of the Project-Based Learning model:

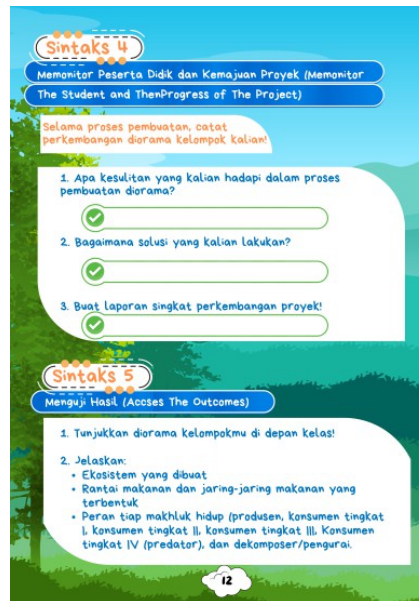


Figure 10. Monitoring Students, Project Progress, and testing Result Syntax

In the final syntax display, several reflection questions are presented to evaluate the learning process that has been completed. The following figure illustrates the sixth syntax of the Project-Based Learning model:



Figure 11. Evaluate Experience Syntax

After completing the LKPD design in the Canva platform, the researcher transferred the design into the Liveworksheet platform. The following are the displays of the E-LKPD design in Canva and Liveworksheet, along with the link to access the E-LKPD:



Figure 12. E-LKPD Link on Liveworksheet

After the E-LKPD design was completed, the product underwent a feasibility evaluation through expert validation. The validation process encompassed three assessment aspects and involved six experts, consisting of material experts, language experts, and graphic/design experts. Each aspect was evaluated by two validators. The expert evaluation results for all three aspects material, language, and graphic design of the Project-Based Learning-oriented E-LKPD on the topic Predator-Prey Relationships, supported by Liveworksheet, are presented in the following table:

Table 3. Summary of Expert Validation Results for the E-LKPD

Aspect	Item No.	ΣS	Aiken's V	Interpretation
Content	1	4.00	0.67	Moderate
	2	6.00	1.00	Very Valid
	3	6.00	1.00	Very Valid
Language	1	6.00	1.00	Very Valid
	2	5.00	0.83	Very Valid
	3	4.00	0.67	Moderate
	4	6.00	1.00	Very Valid
Graphics	1	6.00	1.00	Very Valid
	2	6.00	1.00	Very Valid
	3	6.00	1.00	Very Valid

Following the results of the expert validation of the material, a reliability test was conducted to determine the percentage of agreement between the two validators. The reliability test results are presented in the following table:

Aspect	Item No.	Validator 1 Score	Validator 2 Score	Score Difference	No. of Agreement	No. of Statements	Agreement (%)	Agreement Level
Content	1	3	3	0	3	3	100	Very Strong
Content	2	4	4	0	3	3	100	Very Strong
Content	3	4	4	0	3	3	100	Very Strong
Language	1	4	4	0	3	4	75	Strong
Language	2	4	3	1	3	4	75	Strong
Language	3	3	3	0	3	4	75	Strong
Language	4	4	4	0	3	4	75	Strong
Graphics	1	4	4	0	3	3	100	Very Strong
Graphics	2	4	4	0	3	3	100	Very Strong
Graphics	3	4	4	0	3	3	100	Very Strong

Language, and Visual Design), it was found that all three aspects were interpreted as highly valid. Furthermore, the reliability analysis showed that the validators demonstrated very strong agreement on the content and visual design aspects, while strong agreement was observed for the language aspect.

Following the feasibility assessment of the E-LKPD product, validation was also conducted on the test instrument, covering the aspects of content, language, and construct. Each test item was evaluated by six validators. A summary of the item validation results is presented in the following table:

Table 5. Summary of Test Item Validation Results

Aspect	Item No.	ΣS	Aiken's V	Interpretation
Content	1	5.00	0.83	Very Valid
Content	2	5.00	0.83	Very Valid
Content	3	5.40	0.90	Very Valid
Content	4	5.00	0.83	Very Valid
Content	5	4.60	0.77	Moderate
Language	1	5.00	0.83	Very Valid
Language	2	5.00	0.83	Very Valid
Language	3	5.34	0.89	Very Valid
Language	4	5.00	0.83	Very Valid
Language	5	4.33	0.72	Moderate
Construction	1	4.33	0.72	Moderate
Construction	2	5.00	0.83	Very Valid
Construction	3	5.00	0.83	Very Valid
Construction	4	5.34	0.89	Very Valid
Construction	5	4.33	0.72	Moderate

After obtaining the results of the expert validation, a reliability test was conducted to determine the percentage of agreement between the two validators. The results of the item reliability test are presented in the following table:

Table 6. Summary of Test Item Reliability Results

Aspect	Item No.	Agreement (%)	Criteria
Content	1	80	Strong
	2	80	Strong
	3	80	Strong
	4	80	Strong
	5	80	Strong
Language	1	67	Strong
	2	67	Strong
	3	100	Very Strong
	4	67	Strong
	5	67	Strong
Construction	1	67	Strong
	2	67	Strong
	3	67	Strong
	4	100	Very Strong
	5	67	Strong

Based on the results presented above, it can be observed that all five test items were deemed valid by expert validators across the three assessed aspects. Furthermore, the experts for each aspect demonstrated strong to very strong agreement, as indicated by the reliability analysis.

At the implementation stage, the revised E-LKPD—developed using the Project-Based Learning model and supported by Liveworksheet, and refined based on expert

validation—was applied in the classroom to evaluate its feasibility. This stage involved collecting responses from teachers and students, as well as conducting an empirical validity test of the assessment instrument. Teacher response data were obtained through questionnaire analysis completed by the Grade V teacher at SD Negeri 22 Rejang Lebong. Student responses were gathered from the analysis of questionnaires administered to ten Grade V students who participated in the trial and served as users of the Project-Based Learning-based E-LKPD assisted by Liveworksheet. The results of teacher and student responses are presented in the following table:

Table 7. Analysis Results of Teacher and Student Responses

User	Aspect	Max. Score	Score Obtained	Percentage (%)	Criteria
Teachers	E-LKPD appearance	3	3	100	Very Interesting
	Clarity of Content	3	3	100	Very Interesting
	Language Usage	3	2	67	Interesting
Students	E-LKPD appearance	30	28	93	Very Interesting
	Clarity of Content	30	27	90	Very Interesting
	Language Usage	30	26	87	Very Interesting

Based on the table above, it can be observed and concluded that both teachers and students responded very positively to the use of the Project-Based Learning-based E-LKPD supported by Liveworksheet. The implementation of learning activities was carried out effectively, as the teacher and students followed the classroom instruction in accordance with the teaching module according to the teaching module, using the Project-Based Learning (PBL) model integrated with the Liveworksheet-assisted E-LKPD on the topic Predator-Prey Relationships. The learning process was conducted over two days, with the first day covering PBL syntax stages one to three, and the second day covering stages four to six.

Throughout the learning process, the teacher demonstrated consistency in applying the PBL model combined with the Liveworksheet-based E-LKPD. Observation results indicated that the teacher implemented the instructional stages in accordance with the PBL syntax. Students also exhibited various forms of engagement during each PBL stage, and observation findings showed that they were actively involved throughout the learning activities.

Prior to implementation in the trial class, which consisted of 20 students, the pretest and posttest instruments were validated by two experts for each domain. The validation involved three categories: content validation, language validation, and construct validation. The purpose of this validation process was to ensure that the test instruments developed were appropriate and effective for measuring students' cognitive learning outcomes. After obtaining the trial test scores, the data were analyzed to determine item validity, test reliability, item difficulty level, and item discrimination index.

The item validity test was conducted to examine the validity of each test item used in the learning process. Invalid items were revised or replaced, while valid items were used in the pretest and posttest. The results of the validity test are presented in the following table:

Table 8. Results of Test Item Validity Analysis

Item No.	r-count	Criteria	Remark
1st Question	0.606	High	Valid
2nd Question	0.703	High	Valid
3rd Question	0.650	High	Valid
4th Question	0.550	Adequate	Valid
5th Question	0.682	High	Valid

The results of the item validity testing presented in the table above indicate that the calculated r value (r_{hs}) is greater than or equal to the table value (r_{tabel}) at a 5% significance level. Thus, all test items were found to be valid, with validity coefficients ranging from 0.550 to 0.703. These values demonstrate that each item has a strong correlation with the indicators being measured across the cognitive levels of applying (C3), analyzing (C4), evaluating (C5), and creating (C6). Accordingly, the test instrument is appropriate for assessing students' cognitive abilities in alignment with the targeted cognitive domains.

The reliability of the test instrument was examined using Cronbach's Alpha, yielding a coefficient of 0.639. Based on the interpretation of reliability coefficient categories, this value indicates a moderate level of reliability. The item difficulty test was conducted to evaluate the level of difficulty of each test item used in this study, categorized into difficult, moderate, and easy levels. The results of the item difficulty analysis are presented in the following table:

Table 9. Results of Item Difficulty Analysis

Item No.	Average	Difficulty Level	Criteria
1st Question	6.25	0.62	Adequate
2nd Question	8.50	0.56	Adequate
3rd Question	14.00	0.70	Adequate
4th Question	14.00	0.70	Adequate
5th Question	17.50	0.70	Adequate

Based on the results of the item difficulty index analysis, it can be concluded that all test items fall within the moderate difficulty category, with difficulty index values ranging from 0.56 to 0.70. These findings indicate that the test items exhibit an appropriate balance in terms of difficulty level. The discrimination index analysis was conducted to determine the extent to which each test item differentiates between students with high and low levels of understanding. The results of the discrimination index analysis are presented in Table 10.

Table 10. Results of Item Discrimination Analysis

Item No.	Corrected Item Total Correlation	Criteria
1st Question	0.416	Good
2nd Question	0.480	Good
3rd Question	0.428	Good
4th Question	0.299	Adequate
5th Question	0.368	Adequate

Based on the table above, the test items demonstrated discrimination indices that fell within the good to very good categories, with values ranging from 0.299 to 0.480. This indicates that the items were capable of distinguishing students' varying levels of understanding effectively.

The learning process in this study employed a One-Group design, in which instruction was conducted exclusively in Class V B, designated as the experimental group. The evaluation of students' learning outcomes was carried out by comparing their cognitive achievement scores on the pretest and posttest. The pretest consisted of open-ended questions administered prior to the intervention, while the posttest – comprising the same set of open-ended questions – was administered following the intervention.

The intervention provided to the experimental group consisted of learning activities using an E-LKPD based on the Project-Based Learning (PBL) model assisted by Liveworksheet, aimed at improving students' cognitive learning outcomes. The N-Gain test was employed to determine the effectiveness of this PBL-based E-LKPD in enhancing students' cognitive performance. The results of the N-Gain analysis for the pretest and posttest are presented in Table 11.

Table 11. Results of the N-Gain Analysis for Pretest and Posttest.

Class	N	N-Gain Score	% N-Gain	Interpretation
Experiment	20	0.8	80.9	High

Based on the N-Gain test results presented in the table above, the use of the E-LKPD achieved a high interpretation category, indicated by an average N-Gain score of 0.8 or 80.9%. Therefore, the implementation of the E-LKPD is proven to be effective in enhancing students' understanding. It can thus be concluded that the developed E-LKPD contributes significantly to improving students' cognitive learning outcomes.

Discussion

The findings of this study demonstrate that the Project-Based Learning (PBL)-oriented E-LKPD assisted by Liveworksheet was effective in improving students' cognitive learning outcomes in IPAS learning. The high N-Gain score of 0.8 (80.9%) indicates that students experienced substantial improvement after participating in learning activities using the developed E-LKPD. This result confirms that integrating interactive multimedia, project-based activities, and digital worksheets can support students in understanding ecosystem concepts more effectively.

The effectiveness of the developed E-LKPD is closely related to its instructional design. The E-LKPD was developed systematically using the ADDIE model, ensuring alignment between learning objectives, learning activities, and assessment components. The integration of videos, images, guiding questions, and collaborative project activities encouraged students to become more active participants during the learning process. Moreover, the implementation of PBL syntax enabled students to analyze, evaluate, and create solutions through the food-web diorama project, which contributed to the improvement of higher-order cognitive skills.

These findings are consistent with previous studies reporting that E-LKPD integrated with Liveworksheet can improve students' learning outcomes and engagement. Atmojo et al. (2022) found that interactive LKPD assisted by Liveworksheet improved students' cognitive learning outcomes in science learning. Similarly, Azizah et al. (2024) reported that PBL integrated with Liveworksheet-based E-LKPD increased students' learning

achievement and participation in science learning activities. In addition, Tupan et al. (2024) emphasized that Project-Based Learning encourages collaboration, creativity, and problem-solving skills among elementary school students.

However, the findings of this study show a higher effectiveness level compared to several previous studies that reported moderate improvements in learning outcomes. One possible explanation for this difference is the integration of multimedia features and contextual project activities within the E-LKPD, which were specifically designed according to students' characteristics and learning needs. In this study, students not only completed worksheet tasks but also actively constructed a food-web diorama project, enabling them to apply conceptual understanding in meaningful real-world contexts. This learning experience may have strengthened students' comprehension and retention of ecosystem concepts.

Another contributing factor is the flexibility provided by the Liveworksheet platform. Students were able to access learning materials through digital devices, making the learning process more interactive and engaging compared to conventional printed worksheets. Previous studies often focused only on digital worksheets without fully integrating collaborative project-based learning activities. Therefore, the combination of PBL syntax and Liveworksheet-assisted E-LKPD in this study may explain the stronger improvement in students' cognitive outcomes.

Despite these positive findings, several limitations should be acknowledged. The study involved a relatively small sample size and was conducted in only one school setting. In addition, the implementation period was limited to one learning topic in IPAS. Future studies are recommended to apply the developed E-LKPD in broader contexts, different grade levels, and various subject areas to further examine its effectiveness and adaptability.

Overall, the findings confirm that the developed PBL-oriented E-LKPD assisted by Liveworksheet is valid, feasible, and effective for supporting cognitive learning outcomes in elementary IPAS instruction. The product also provides an innovative alternative learning resource that supports interactive, student-centered, and technology-integrated learning practices.

CONCLUSION

This study developed an E-LKPD integrating the Project-Based Learning (PBL) model supported by Liveworksheet with the aim of improving the cognitive learning outcomes of fifth-grade elementary students. The findings demonstrate that the developed product aligns with the Learning Outcomes established by BSKAP (2025) and is appropriately structured according to the six phases of the PBL syntax. Its integration of interactive multimedia, comprehensive content, and communicative language effectively supports conceptual understanding, fosters active engagement, and accommodates learner characteristics.

The feasibility testing results indicate that the E-LKPD meets the criteria for content, language, and graphic appropriateness. Expert validation revealed moderate to very high validity across all aspects, with reliability coefficients categorized as strong to very strong. In addition, the E-LKPD received highly positive responses from teachers and students, particularly regarding its visual design, relevance and clarity of content, and accessible language use.

Furthermore, the PBL-based E-LKPD supported by Liveworksheet was proven effective in enhancing students' cognitive learning outcomes. This is evidenced by the high N-Gain score of 0.8 (80.9%), indicating a substantial improvement among students in the experimental group.

Overall, the findings confirm that the developed PBL-based E-LKPD is feasible, practical, and effective as a technology-integrated learning resource for supporting cognitive achievement in elementary IPAS instruction.

REFERENCES

- Abduh., M. (2019). Panduan Penilaian Tes Tertulis. Pusat Penilaian Pendidikan. Afifah, T. F., & Junaedi, A. (2024a). Liveworksheet-Based E-LKPD and Interest in Learning Improves Science and Social Learning Outcomes for Elementary School Students. *Journal of Education Research and Evaluation*, 8(3), Article 3. <https://doi.org/10.23887/jere.v8i3.78207>
- Afifah, T. F., & Junaedi, A. (2024b). Liveworksheet-Based E-LKPD and Interest in Learning Improves Science and Social Learning Outcomes for Elementary School Students. *Journal of Education Research and Evaluation*, 8(3), 433-442. <https://doi.org/10.23887/jere.v8i3.78207>
- Agusdianita, N. (2023). Model Pembelajaran PBL Untuk Meningkatkan Hasil Belajar Mahasiswa pada Perkuliahan Pengembangan Pembelajaran Tematik. *Social, Humanities, and Educational Studies (SHES): Conference Series*, 6(3). <https://doi.org/10.20961/shes.v6i3.82319>
- Agusdianita, N., Puspita, Y. R. A., Kasthori, M., Bella, Z. S., & Ilahi, T. W. F. T. (2025). Penerapan Model Tgt Dalam Meningkatkan Aktivitas & Hasil Belajar Pada Pembelajaran Pendidikan Pancasila Kelas Vd Sdn 5 Kota Bengkulu. *Prosiding Temu Ilmiah Nasional Guru*, 16, 81-88.
- Agustin, N., & Maryani, I. (2021). Peran Guru dalam Membentuk Karakter Siswa (Antologi Esai Mahasiswa Pendidikan Guru Sekolah Dasar). UAD Press.
- Akbar, S. (2013). Instrumen Perangkat Pembelajaran. Remaja Rosdakarya. Akhir, M. (2022). Materi Ajar Bahasa Indonesia Berbasis Karakter. Penerbit Adab.
- Ali, M., K. Ali, M., A. Ali, F., F. Ali, I., R., & Hasanah, A. (2025). Membangun Kompetensi Berpikir Tinggi dan Keterampilan Kerja: Analisis Perbandingan Taksonomi Bloom Revisi dan Taksonomi Simpson/Harrow dalam Konteks Pendidikan SMA dan SMK. *Cognoscere: Jurnal Komunikasi Dan Media Pendidikan*, 3(1), Article 1. <https://doi.org/10.61292/cognoscere.260>
- Al-Tabany, T. I. B. (2017). Mendesain Model Pembelajaran Inovatif, Progresif, Dan Konteksual. Prenada Media.
- Ananda, R. W., & Soro, S. (2023). Pengaruh penggunaan lembar kerja peserta didik elektronik (E-LKPD) terhadap hasil belajar matematika di SMA Hang Tuah 1 Jakarta. *Jurnal Lebesgue: Jurnal Ilmiah Pendidikan Matematika, Matematika dan Statistika*, 4(2), Article 2. <https://doi.org/10.46306/lb.v4i2.329>
- Antari, P. L., Widiana, I. W., & Wibawa, I. M. C. (2023). Modul elektronik berbasis project based learning pembelajaran IPAS untuk meningkatkan hasil belajar siswa sekolah dasar. *Jurnal Ilmiah Pendidikan dan Pembelajaran*, 7(2), Article 2. <https://doi.org/10.23887/jipp.v7i2.60236>
- Asry Tesalonika, Y., Dwikuenaningsih, Y., & Ismanto, B. (2024). Project-based learning: Berbasis Google Workspace dalam manajemen Kurikulum Merdeka. PT Kanisius.

- Atmojo, I. R. W., & Chumdari. (2022). Assesmen dalam buku tematik. CV Pajang Putra Wijaya.
- Atmojo, I. R. W., Matsuri, M., Adi, F. P., Ardiansyah, R., & Saputri, D. Y. (2022). Pemanfaatan LKPD interaktif berbasis Liveworksheet untuk meningkatkan hasil belajar kognitif muatan IPA peserta didik kelas V di SD Negeri Jajar Kota Surakarta. *Jurnal Pengabdian UNDIKMA*, 3(2), 241–249.
- Ayuningrum, Y. S., & Saputra, H. J. (2024). Penerapan model pembelajaran Project Based Learning (PBL) terhadap keterampilan pemecahan masalah pada pembelajaran IPAS. *Innovative: Journal of Social Science Research*. <https://j-innovative.org/index.php/Innovative/article/view/10062>
- Azis, N. A., Aminullah, A., & Kining, E. (2025). Pengembangan bahan ajar E-LKPD interaktif berbasis website Liveworksheet untuk meningkatkan kemampuan kognitif peserta didik kelas V pada mata pelajaran IPA di UPT SDN 1 Enrekang. *Cokroaminoto Journal of Primary Education*, 8(1), 404–420. <https://doi.org/10.30605/cjpe.8.1.2025.5600>
- Azizah, S., Dewi, N. K., & Sutantri, S. (2024a). Pembelajaran berdiferensiasi model project based learning (PBL) dengan media E-LKPD Liveworksheet untuk meningkatkan hasil belajar IPA. *JPG: Jurnal Pendidikan Guru*, 5(4), Article 4.
- Azizah, S., Dewi, N. K., & Sutantri, S. (2024b). Pembelajaran berdiferensiasi model Project Based Learning (PBL) dengan media e-LKPD Liveworksheet untuk meningkatkan hasil belajar IPA. *JPG: Jurnal Pendidikan Guru*, 5(4), Article 4.
- Azzahra, F. Y. (2025). The influence of project-based learning model assisted by HOTS-based interactive student worksheet (LKPD) on critical thinking. *SPEKTRA: Jurnal Kajian Pendidikan Sains*, 11(1), 171–185. <https://doi.org/10.32699/spektra.v11i1.9149>
- Badan Standar, Kurikulum, dan Asesmen Pendidikan. (2025). Keputusan Menteri Badan Standar, Kurikulum, dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Indonesia Nomor 12 Tahun 2025.
- Badan Standar Nasional Pendidikan. (2016). [Judul dokumen tidak tersedia]. [Incomplete reference]
- Cholifah, S. N., & Novita, D. (2022). Pengembangan E-LKPD guided inquiry-Liveworksheet untuk meningkatkan literasi sains pada submateri faktor laju reaksi. *Chemistry Education Practice*, 5(1), 23–34. <https://doi.org/10.29303/cep.v5i1.3280>
- Aprinastuti, C., et al. (2023). Special book for media tutorial ICT-based learning. Stiletto Book.
- Dianawati, E. P. (2022). Project based learning (PBL): Solusi ampuh pembelajaran masa kini. Penerbit P4I.
- Nyihana, E. (2021). Metode PBL (project based learning) berbasis scientific approach dalam berpikir kritis dan komunikatif bagi siswa. Penerbit Adab.
- Sawitri, E. R. (2023). Model discovery learning berbantuan komik untuk meningkatkan minat dan hasil belajar. *Uwais Inspirasi Indonesia*.
- Fadhila, H., Hartini, H., & Rohmadi, R. (2024). Penerapan Liveworksheet untuk meningkatkan minat dan hasil belajar peserta didik pada materi pecahan senilai di kelas IV SD Negeri 04 Klegen Madiun tahun pelajaran 2023/2024. *Seminar Nasional Sosial, Sains, Pendidikan, Humaniora (SENNASDRA)*, 3(1), Article 1.
- Fahrizy, R. M., & Fathurrahman, M. (2024). Development of interactive E-LKPD Liveworksheet based on differentiated instruction in IPAS subjects fifth grade. *Jurnal*

- Penelitian Pendidikan IPA, 10(8), 5867-5876.
<https://doi.org/10.29303/jppipa.v10i8.7366>
- Faridi, F. (2023). Penggunaan media interaktif Liveworksheet untuk meningkatkan hasil belajar materi bilangan berpangkat kelas IX A SMP Negeri 2 Kandang Serang. *EDUTECH: Jurnal Inovasi Pendidikan Berbantuan Teknologi*, 3(1), Article 1. <https://doi.org/10.51878/edutech.v3i1.2121>
- Ferdinand, F., Wantu, H. M., Insani Ilham, C., Nduru, M. P., & Sumiyati, S. (2023). Top 10 model pembelajaran abad 21. Penerbit Adab.
- Fitriyah, I. J., Salamah, I. D., & Ramadhan, U. L. (2024). The effectiveness of E-LKPD with a scientific approach using Liveworksheet in improving learning outcomes on the interaction of living things with the environment. *AIP Conference Proceedings*, 3106(1), 030040. <https://doi.org/10.1063/5.0215207>
- Fitriyah, N. K., Suhartono, S., & Chamdani, M. (2024). Penerapan model Problem Based Learning (PBL) berbantuan LKPD elektronik untuk meningkatkan hasil belajar IPAS pada siswa kelas V sekolah dasar. *Kalam Cendekia: Jurnal Ilmiah Kependidikan*, 12(3), Article 3. <https://doi.org/10.20961/jkc.v12i3.85414>
- Gani, R. A., Windiyani, T., Hikmah, N., & Sabila, F. H. (2024). Pengembangan E-LKPD berbasis Project Based Learning berbantuan Liveworksheet pada pembelajaran IPA di siswa sekolah dasar. *Seminar Nasional & Prosiding Pendidikan Dasar*, 1(1), 231-242.
- Hamidah, N., Rusilowati, A., Ellianawati, Subali, B., & Lestari, W. (2024). Analisis kebutuhan E-LKPD berbantuan Liveworksheet pada pembelajaran IPA untuk meningkatkan kemampuan berpikir kritis peserta didik sekolah dasar. *Didaktik: Jurnal Ilmiah PGSD STKIP Subang*, 10(2), Article 2. <https://doi.org/10.36989/didaktik.v10i2.2965>
- Hanan, J., Irawan, P. T., & Naryatmojo, D. L. (2025). Evaluasi kesesuaian penilaian sumatif akhir jenjang kelas XII dengan distribusi ranah kognitif dalam Kurikulum Merdeka. [Manuscript in preparation or unpublished work if no publication venue provided].
- Hanny Firts Anianta, & Khofifah, I. (2022). Efektivitas E-LKPD berbantuan Liveworksheet untuk meningkatkan hasil belajar peserta didik. *Proceeding UMS Surabaya*. <https://journal.um-surabaya.ac.id/Pro/article/view/14918>
- Hardiansyah, H., Asmawi, U. S., & Darmansyah, A. (2023). Pengembangan LKPD interaktif dalam pembelajaran berdiferensiasi. *DWIJA CENDEKIA: Jurnal Riset Pedagogik*, 7(3), Article 3. <https://doi.org/10.20961/jdc.v7i3.78584>
- Hasanudin, C., Matin, M. F., & Sutrimah, S. (2025). Menulis teks biografi dengan model pembelajaran Project Based Learning. *Seval Literindo Kreasi*.
- Hayati, R., Ersani, E., Darwiyanti, A., Akbar, S., Hadikusumo, R. A., Hamda, E. F., Simanungkalit, L. N., Missouri, R., Winarsih, S., Priyanti, N. Y., Syarifah, T., Suyitno, M., Wardoyo, T. H., Hatiningsih, N., Ariantara, R. G., Nurdini, Isminarti, Talindong, A., & Azizah, H. N. (2025). Pengembangan bahan ajar. *Sada Kurnia Pustaka*.
- Hendriana, H., & Elizabeth, Y. (2025). Ragam asesmen dan strategi inovatif untuk pendidikan dasar. *Indonesia Emas Group*.
- Hendrianty, B. J., Ibrahim, A., Iskandar, S., & Mulyasari, E. (2024). Membangun pola pikir deep learning guru sekolah dasar. *Kalam Cendekia: Jurnal Ilmiah Kependidikan*, 12(3). <https://doi.org/10.20961/jkc.v12i3.96699>

- Herlina, P., Hamdu, G., & Nugraha, A. (2023). Elektronik lembar kerja peserta didik (E-LKPD) interaktif berbasis Education for Sustainable Development (ESD) di SD. Pendas: Jurnal Ilmiah Pendidikan Dasar, 8(2), Article 2. <https://doi.org/10.23969/jp.v8i2.8782>
- Hidayah, A. N., Winingsih, P. H., & Amalia, A. F. (2020). Development of physics e-LKPD (electronic worksheets) using 3D Pageflip based on problem-based learning on balancing and rotation dynamics. Jurnal Ilmiah Pendidikan Fisika-COMPTON.
- Hurrahma, M., & Sylvia, I. (2022). Efektivitas E-LKPD berbasis Liveworksheet dalam meningkatkan hasil belajar sosiologi peserta didik di kelas XI IPS SMA N 5 Padang. Jurnal Sikola: Jurnal Kajian Pendidikan dan Pembelajaran, 4(1), 14–22. <https://doi.org/10.24036/sikola.v4i1.193>
- Iriani, R., Leny, L., Misbah, M., Rinaya, M. J., Nana, N., Sopranti, N., Muhaimin, M., & Norhasanah, H. (2023). Penyusunan lembar kerja peserta didik (LKPD) kimia menggunakan Liveworksheet untuk meningkatkan kualitas pembelajaran pada Kurikulum Merdeka. Bubungan Tinggi: Jurnal Pengabdian Masyarakat, 5(4), 1679. <https://doi.org/10.20527/btjpm.v5i4.10085>
- Judijanto, L., Haryani, H., Sari, N., Pranata, A., Mutoharoh, M., Lumbu, A., Tumober, R. T., Prisuna, B. F., & Wiradika, I. N. I. (2025). Assessment, testing dan evaluasi. PT Sonpedia Publishing Indonesia.
- Julianti, D., Hartatiana, & Efriani, A. (2025). Transformasi pembelajaran interaktif berbasis budaya lokal. Bening Media Publishing.
- Khairiah, D., Jf, N. Z., Iqroma, M., Harahap, N. A., Asnah, Hamidah, Indriani, R. A., Yenni, Asfiati, Hanifah, Lelya, Syafrilianto, Harahap, H. E., Magdalena, Suparni, Nasution, L. A. A., Nurhalimah, Rambe, F. A., & Rambe, A. W. (2022). Prosiding Seminar Nasional Prodi PGMI dan PIAUD IAIN Padangsidimpuan. Samudra Biru.
- Kosasih. (2021). Pengembangan bahan ajar. Bumi Aksara.
- Kusuma, W., Sumeni, M., & Chasannatun, F. (2024). Upaya meningkatkan kemampuan kognitif peserta didik melalui pendekatan TaRL dan model PBL pada kelas V SDN 02 Tawangrejo dalam mata pelajaran IPAS. MARAS: Jurnal Penelitian Multidisiplin, 2(3), 1467–1476. <https://doi.org/10.60126/maras.v2i3.422>
- Loka, D. N., & Robiah, R. S. (2024). Penerapan model pembelajaran berbasis proyek (PBL) dalam meningkatkan kemampuan kerja sama anak usia dini. [Publication details not provided].
- Made Merri Tarisna, Suma, K., & Wibawa, I. M. C. (2023). Efektifitas E-LKPD berbasis Project Based Learning pada muatan pembelajaran IPA di kelas V sekolah dasar. Jurnal Ilmiah Pendidikan Profesi Guru. <https://ejournal.undiksha.ac.id/index.php/JIPPG/article/view/62088>
- Magdalena, I. (2022). Teori dan praktik evaluasi pembelajaran SD. CV Jejak (Jejak Publisher).
- Mahanani, V. I., Susilowati, S. A., & Mujarti, S. (2023). Penerapan Liveworksheet untuk meningkatkan hasil belajar matematika kelas IV di SD Negeri Sragen 18. Educatif Journal of Education Research, 5(2), Article 2. <https://doi.org/10.36654/edukatif.v5i2.284>
- Mardhatilah, R., Zaini, M., & Kaspul, K. (2022). Pengaruh LKPD-elektronik sistem gerak terhadap hasil belajar dan keterampilan berpikir kritis peserta didik: Effect of movement system LKPD-Electronic on learning outcomes and critical thinking skills

- of students. Practice of the Science of Teaching Journal: Jurnal Praktisi Pendidikan, 1(2), Article 2. <https://doi.org/10.58362/hafecspost.v1i2.13>
- Markhamah, Sufanti, M., Sabardila, A., & Winarni, E. W. (2020). Pembelajaran ejaan di sekolah dasar: Untuk meningkatkan kemampuan berpikir tingkat tinggi. Muhammadiyah University Press.
- Ma'rufi, M. I., & Pasandaran, R. F. (2025). Esensi Merdeka Belajar. Nas Media Pustaka.
- Maulani, J., Kelana, J. B., & Jayadinata, A. K. (2022). Pengembangan LKPD berbantuan Liveworksheet untuk meningkatkan pemahaman konsep IPA siswa kelas IV SD. Jurnal Profesi Pendidikan, 1(2), Article 2. <https://doi.org/10.22460/jpp.v1i2.11613>
- McHugh, M. L. (2012). Interrater reliability: The kappa statistic. Biochemia Medica, 22(3), 276–282.
- Megawati, R., Jirana, J., Ridianingsih, D. S., Djarwo, C. F., & Nasrianty, N. (2024). Flipped classroom: Pembelajaran inovatif untuk generasi digital. PT Sonpedia Publishing Indonesia.
- Mudrikah, S., Pahleviannur, M. R., Surur, M., Rahmah, N., Siahaan, M. N., Wahyuni, F. S., Zakaria, Widyaningrum, R., Saputra, D., Prihastari, E. B., Ramadani, S. D., & Nurhayati, R. (2021). Perencanaan pembelajaran di sekolah: Teori dan implementasi. Pradina Pustaka.
- Muh, R. (2024). Pendidikan IPA di SD. Nas Media Pustaka.
- Muktedir, A., Susanti, A., Darmansyah, A., Febrina, W., & Irmayanti, M. (2024). Problem-based learning: Making caricature as teaching material based on folklore Sang Piatul for Indonesian language learning. LITERA, 23(2), 210–223. <https://doi.org/10.21831/ltr.v23i2.72541>
- Munir, Rasim, Ranggana, A., & Dwi Fitria Al Husaeni. (2023). Kajian pedagogik pendidikan ilmu komputer. Indonesia Emas Group.
- Nasution, U. F., Arifin, M., & Nurasiah, N. (2024). Penggunaan E-LKPD interaktif berbantuan Liveworksheet untuk meningkatkan hasil belajar matematika pada siswa kelas II SDN 064974 Medan. Jurnal Handayani PGSD FIP UNIMED, 15(2), Article 2. <https://doi.org/10.24114/jh.v15i2.64398>
- Nasution, Z. (2022). Selayang pandang ilmu pendidikan. Penerbit NEM.
- Triana, N. (2021). LKPD berbasis eksperimen: Tingkatkan hasil belajar siswa. Guepedia.
- Novelti, & Safira, S. (2025). Inovasi pembelajaran menulis: Mengoptimalkan project based learning menggunakan media film pendek. Deepublish.
- Nurbaiti. (2024). Anatomi fisiologi dalam project based learning. Penerbit P4I.
- Nurhasanah, I., Wijayanti, A., & Sary, R. M. (2024). Keefektifan model project based learning (PBL) berbantu media konkret terhadap minat dan hasil belajar IPAS kelas V sekolah dasar. EDUCATIONAL: Jurnal Inovasi Pendidikan & Pengajaran, 4(4), 430–442. <https://doi.org/10.51878/educational.v4i4.3828>
- Nurul Hidayah, & Asari, S. (2022). Investigating students' listening skill using Liveworksheet as an outline teaching platform. J-SHMIC: Journal of English for Academic, 9(1), 51–59. [https://doi.org/10.25299/jshmic.2022.vol9\(1\).8611](https://doi.org/10.25299/jshmic.2022.vol9(1).8611)
- Parwati, N. N., Suryawan, I. P. P., & Apsari, R. A. (2023). Belajar dan pembelajaran. PT RajaGrafindo Persada.
- Prakoso, N. A., & Rusnilawati, R. (2024). Analisis model project based learning berbantuan Liveworksheet dalam meningkatkan prestasi belajar dan keterampilan

- literasi sains. Muallimuna: Jurnal Madrasah Ibtidaiyah, 9(2), Article 2. <https://doi.org/10.31602/muallimuna.v9i2.14304>
- Prastowo. (2015). Panduan kreatif membuat bahan ajar inovatif: Menciptakan metode pembelajaran yang menarik dan menyenangkan. DIVA Press.
- Prawesti, L., N., I., Susanto Putro, A. N., Pratiwi, M., Ibrahim, S. M., Saragih, K. F., & Srirahmawati, I. (2024). Media pembelajaran. Lakeisha.
- Prista, D., Sumarmi, S., Mutia, T., Utaya, S., & Bernadi, A. I. (2023). Pengembangan e-LKPD berbasis game-based learning berbantuan Liveworksheet pada materi pemetaan. Jurnal Integrasi dan Harmoni Inovatif Ilmu-Ilmu Sosial, 3(12). <https://doi.org/10.17977/um063v3i12p1380-1395>
- Puspitasari, L., Nasrah, N., & Amal, A. (2024). Pengaruh model project based learning (PBL) terhadap hasil belajar IPA siswa SD. Jurnal Riset dan Inovasi Pembelajaran, 4(1), 232-242. <https://doi.org/10.51574/jrip.v4i1.1305>
- Putri, E. I. E. (2023). Model pembelajaran cooperative project based learning dalam menurunkan demotivasi. LPPM Ibrahimy Genteng Banyuwangi.
- Rachmawati, D. W., Ghozali, M. I. A., Nasution, B., Firmansyah, H., & Asiah, S. (2021). Teori & konsep pedagogik. Penerbit Insania.
- Rachmawati, Wijayanti, R., & Kartika, E. D. (2021). Media mobile learning pada matematika: Berbasis pendidikan karakter dalam menunjang revitalisasi SMK. Media Nusa Creative.
- Rusdan, M., & Mulya, D. B. (2023). The effect of using Liveworksheet-based electronic worksheets to measure cognitive learning outcomes. Edunesia: Jurnal Ilmiah Pendidikan, 4(3). <https://doi.org/10.51276/edu.v4i3.481>
- Sanulita, H., Syamsurijal, S., Ardiansyah, W., Wiliyanti, V., & Megawati, R. (2024). Strategi pembelajaran: Teori & metode pembelajaran efektif. PT Sonpedia Publishing Indonesia.
- Saparuddin. (2022). Inovasi pembelajaran. CV Jejak.
- Saptadi, N. T. S., Purwati, H., Septiani, S., Zuraini, Guspiati, S., Maulani, G., Wahyuni, A., Halim, F. A., Kaif, S. H., Fajrianti, Hadikusumo, R. A., Meisarah, F., Saputri, L., Susilowaty, N., Missouri, R., & Edi, S. (2023). Micro teaching: Teoritis & praktis. Sada Kurnia Pustaka.
- Sarapudin, Y. (2023). Pembelajaran IPA, kompetensi guru, dan supervisi. Jakad Media Publishing.
- Septonanto, D., Nugrahani, F., & Widayati, M. (2024). Pengembangan media E-LKPD Liveworksheet soal HOTS untuk menguatkan hasil belajar siswa sekolah dasar. Jurnal Ilmiah Pendidikan Citra Bakti, 11(1). <https://doi.org/10.38048/jipcb.v11i1.2315>
- Sinambela, P. N. J. M., Bulan, A., Febrina, A., Susilowaty, N., Fatchurrohman, M., Novianti, W., Sembiring, E. T. B., Chairunnisa, Subroto, D. E., & Mardhiyana, D. (2022). Model-model pembelajaran. Sada Kurnia Pustaka.
- Siregar, N. H., Khadijah, K., Eliza, R., Marhamah, M., Sari, M., & Batubara, J. (2025). The application of the PBL model accompanied by E-LKPD Liveworksheet on learning outcomes in Islamic cultural history. An-Nuha, 5(3), 341-352. <https://doi.org/10.24036/annuha.v5i3.682>
- Sugiarni. (2022). Bahan ajar, media dan teknologi pembelajaran. Pascal Books. Sugiyono. (2017). Metode penelitian kuantitatif dan R&D. Alfabeta.

- Supriatna, A. R., Andriani, R., Usman, H., & Sari, Y. (2024). Digital student worksheet oriented to problem-based learning in science subjects for elementary school students. *MIMBAR PGSD Undiksha*, 12(1), 108–118. <https://doi.org/10.23887/jpgsd.v12i1.60938>
- Surahman, E., Soepriyanto, Y., Wedi, A., & Ulfa, S. (2024a). Online assessment: Panduan guru sekolah dasar. Academia Publication.
- Surahman, E., Soepriyanto, Y., Wedi, A., & Ulfa, S. (2024b). Online assessment: Panduan guru sekolah dasar. Academia Publication.
- Suryandari, Y., Hendrayan, A., & Hariyadi, R. (2023). Pengembangan media E-LKPD berbasis Liveworksheet untuk meningkatkan kemandirian belajar siswa pada mata pelajaran pendidikan agama Islam. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, 8(3). <https://doi.org/10.23969/jp.v8i3.10666>
- Susanti, A., & MuktaDir, A. (2024). Pelatihan pengembangan LKPD elektronik menggunakan aplikasi Liveworksheet pada guru SDN 50 Kota Bengkulu. *Prosiding Seminar Nasional Pengabdian kepada Masyarakat Fakultas Bahasa Asing Universitas Mahasaraswati Denpasar (SENADIBA)*, 58–69.
- Syafrilianto, & Lubis, M. A. (2022). Micro teaching di SD/MI integration 6C. *Samudra Biru*. Tahya, D., & Saija, M. (2023). Buku ajar pembelajaran inovatif. Feniks Muda Sejahtera.
- Triwahyudianto, Isnani, D. R., & Kumala, F. N. (2024). PBL-based Liveworksheet E-LKPD to improve critical thinking ability in 4th class primary school science learning. *Jurnal Bidang Pendidikan Dasar*, 8(1), 96–104. <https://doi.org/10.21067/jbpd.v8i1.10371>
- Tumbel, F. M., & Kawuwung, F. R. (2023). Media pembelajaran. *Selat Media*.
- Tupan, A. A., Marayate, M. R., Latuserimala, S., Leasa, M., & Batlolona, J. R. (2024). Worksheet based on project-based learning in science learning in elementary school. *Jurnal Penelitian dan Pengembangan Pendidikan*, 8(3), 493–505. <https://doi.org/10.23887/jppp.v8i3.79951>
- Wardani, I. U. (2022a). Belajar matematika SD dengan pendekatan scientific berbasis keterampilan. Feniks Muda Sejahtera.
- Wardani, I. U. (2022b). Belajar matematika SD dengan pendekatan scientific berbasis keterampilan. Feniks Muda Sejahtera.
- Wasidi. (2020). Tes dan pengukuran pendidikan. UNIB.
- Widayani, E. (2023). Project based learning (PBL) dengan metode demonstrasi mata pelajaran seni. CV Ruang Tentor.
- Ardianto, W. (2020). Karya inovasi guru penggerak. Qahar Publisher.
- Widyaningrum, S., & Parmiti, D. P. (2024). Contextual teaching and learning-based e-worksheet on science subjects for fourth grade elementary schools. *Mimbar Ilmu*, 29(1), 173–184. <https://doi.org/10.23887/mi.v29i1.64644>
- Winarni. (2018). Teori dan praktik penelitian kuantitatif kualitatif penelitian tindakan kelas (PTK) research and development (R&D). Bumi Aksara.
- Winarni, E. W. (2018). Metodologi penelitian. Unit Penerbitan FKIP UNIB.
- Winarni, E. W. (2018). Pendekatan ilmiah dalam pembelajaran kreatif dan inovatif. FKIP UNIB.
- Wisudawati, A. W., & Sulistyowati, E. (2022). Metodologi pembelajaran IPA. Bumi Aksara.



- Wulandari, N., Noperman, F., & Agusdianita, N. (2024). Pengembangan LKPD model project based learning berbasis STEAM pada mata pelajaran IPAS kelas IV SD. SHES: Conference Series, 7(3). <https://doi.org/10.20961/shes.v7i3.91949>
- Wulandari, N. R., Aka, K. A., & Mukmin, B. A. (2023). Pengembangan LKPD berorientasi pendekatan saintifik dengan aplikasi Liveworksheet untuk siswa kelas IV sekolah dasar. Diajar: Jurnal Pendidikan dan Pembelajaran, 2(1). <https://doi.org/10.54259/diajar.v2i1.1295>
- Yuwono, S. L. (2020). Asiknya mengajarkan sains di kelasku. Tata Akbar.
- Zulaeha, I., Sintarani, C., Aminah, S., & Taripah. (2024). Spektrum pembelajaran bahasa di era merdeka belajar. Cahya Ghani Recovery.

Niky Luthfi Pratiwi (Corresponding Author)

Bengkulu University,
Jl. W.R. Supratman, Kandang Limun, Bengkulu 38371A, Indonesia
Email: nikyluthfipr@gmail.com

Endang Widi Winarni

Department of Master of Primary Education Faculty of Teacher Training and Education,
Bengkulu University,
Jl. W.R. Supratman, Kandang Limun, Bengkulu 38371A, Indonesia
Email: endangwidi@unib.ac.id

Abdul Muktadir

Department of Master of Primary Education Faculty of Teacher Training and Education,
Bengkulu University,
Jl. W.R. Supratman, Kandang Limun, Bengkulu 38371A, Indonesia
Email: abdulmuktadir@unib.ac.id

Osa Juarsa

Department of Master of Primary Education Faculty of Teacher Training and Education,
Bengkulu University,
Jl. W.R. Supratman, Kandang Limun, Bengkulu 38371A, Indonesia
Email: juarsaosa@yahoo.com

Neza Agusdianita

Bengkulu University,
Jl. W.R. Supratman, Kandang Limun, Bengkulu 38371A, Indonesia
Email: nezaagusdianita@unib.ac.id

Hakimee Yasing

Bengkulu University,
Jl. W.R. Supratman, Kandang Limun, Bengkulu 38371A, Indonesia
Email: hakimee.yasing@unib.ac.id
