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Development of LKPD Based on Contextual Teaching Learning (CTL) on Ecosystem Material to Train Learning Independence

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Abstrak: Tujuan penelitian ini adalah untuk mengembangkan bahan ajar yang kontekstual guna meningkatkan kemandirian belajar peserta didik serta mengoptimalkan keterkaitan materi pembelajaran dengan konteks kehidupan nyata. Penelitian ini menggunakan metode penelitian dan pengembangan (*Research and Development*) dengan model ADDIE yang meliputi tahap analisis (*analysis*), perancangan (*design*), pengembangan (*development*), implementasi (*implementation*), dan evaluasi (*evaluation*). Subjek penelitian terdiri atas peserta didik kelas V pada tahap uji terbatas dan uji luas. Teknik pengumpulan data meliputi lembar validasi ahli, angket respons guru dan peserta didik, serta lembar observasi kemandirian belajar. Data dianalisis secara deskriptif kuantitatif dan kualitatif. Hasil penelitian menunjukkan bahwa LKPD berbasis CTL yang dikembangkan memenuhi kriteria sangat valid dengan persentase validasi ahli media sebesar 94% dan ahli materi sebesar 92%. Tingkat kepraktisan pada uji terbatas memperoleh persentase 93%, sedangkan pada uji luas mencapai rata-rata 94,5% dengan kategori sangat praktis. Efektivitas LKPD ditunjukkan oleh hasil observasi uji coba luas yang berada pada kategori mandiri, dengan rata-rata skor 15 (Kelas A) dan 14 (Kelas B), tanpa peserta didik dalam kategori kurang mandiri. Berdasarkan hasil tersebut, dapat disimpulkan bahwa LKPD berbasis CTL pada materi ekosistem yang dikembangkan dinyatakan valid, sangat praktis, dan efektif dalam melatih kemandirian belajar peserta didik, sehingga layak digunakan sebagai bahan ajar dalam pembelajaran IPA di sekolah dasar.
Kata kunci: Contextual Teaching Learning; ekosistem; kemandirian belajar; LKPD.

Abstract: The aim of this research is to develop contextual teaching materials to increase students' learning independence and optimize the connection between learning materials and real-life contexts. This study uses a research and development method with the ADDIE model which includes the stages of analysis, design, development, implementation, and evaluation. The research subjects consisted of fifth-grade students in the limited and extensive testing stages. Data collection techniques included expert validation sheets, teacher and student response questionnaires, and learning independence observation sheets. Data were analyzed descriptively quantitatively and qualitatively. The results showed that the developed CTL-based LKPD met the criteria of very valid with a validation percentage of media experts of 94% and material experts of 92%. The practicality level in the limited test obtained a percentage of 93%, while in the

extensive test it reached an average of 94.5% with a very practical category. The effectiveness of the LKPD is shown by the results of observations of the extensive trial which are in the independent category, with an average score of 15 (Class A) and 14 (Class B), with no students in the less independent category. Based on these results, it can be concluded that the CTL-based LKPD on the ecosystem material developed is declared valid, very practical, and effective in training students' learning independence, so it is suitable for use as teaching materials in science learning in elementary schools.
Keyword: Contextual Teaching and Learning; ecosystem; independent learning; research; Student worksheet.

1. Introduction

The development of basic education in Indonesia amid digital transformation requires learning innovation that emphasizes student-centered approaches and strengthens independent learning skills. Students are positioned as active learners responsible for their learning process. Independent learning is an important competency developed from elementary school, defined as the ability to plan, manage, motivate, and evaluate learning independently. This skill is essential for preparing students as lifelong learners who are ready to face academic and real-life challenges.[1]. Several recent studies have shown that strengthening independent learning in basic education contributes significantly to improving the quality of the learning process and student learning outcomes. The positive relationship between independent learning and academic achievement has also been empirically demonstrated in several educational studies[2].

The urgency of developing independent learning is further strengthened when linked to the demands of the Independent Curriculum, which emphasizes student-centered learning. Other research confirms that students with a high level of learning independence tend to demonstrate stronger intrinsic motivation, persistence in completing assignments, and better self-reflection skills than students who rely on teacher guidance [3]. In addition to internal student factors, the quality of teaching materials design also plays a crucial role in developing independent learning habits. Teaching materials designed systematically, contextually, and reflectively have been shown to stimulate students' metacognitive activity, enabling them to be more focused in controlling their learning process[4].

However, the implementation of learning oriented toward independent learning at the elementary school level still faces various obstacles. In practice, the learning process is still dominated by a teacher-centered approach, limited contextual learning resources, and a lack of teaching materials specifically designed to develop students' self-regulation skills[5]. This condition is also evident in Natural Science (IPA) learning, particularly ecosystems. Ecosystems material has great potential to be developed through authentic experiences because it directly relates to students' surroundings [6].

Other empirical findings indicate that integrating real-world activities into science learning can improve conceptual understanding and foster student learning initiative. Through hands-on experience, students are encouraged to explore, reflect, and independently discover natural phenomena around them[7]. Therefore, developing independent learning needs to be done early on to provide students with a strong foundation as lifelong learners, in line with the direction of national education policy, which emphasizes independent learners and critical reasoners[8].

Based on observations at SDN 61 Seluma, Dusun Baru Village, Seluma District, Seluma Regency, several problems were identified in fifth-grade science learning. Teachers were not optimally utilizing the surrounding environment as a contextual learning resource. Although group discussions and lectures were used, learning outcomes were still unsatisfactory. The Student Worksheets (LKPD) used were unable to encourage active student engagement. Learning activities were still dominated by routine textbook problems, while opportunities for students to express opinions and conduct independent exploration were limited. This situation tends to make learning monotonous, students easily become bored, and conceptual understanding is not yet fully developed [9].

Interviews with fifth-grade teachers show that the average social studies score for the 2024/2025 academic year is still low (5.4), below the KKM of 7.5. This is linked to limited teacher ability in developing innovative teaching materials, due to time constraints and low IT skills, causing reliance

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on textbook worksheets. Therefore, more contextual and practical LKPD are needed to support students' independent learning. Several previous studies have reinforced the urgency of developing CTL-based student worksheets (LKPD). Research by Rahmawati and Hidayat (2022) showed that student worksheets based on Contextual Teaching and Learning (CTL) on the topic of changes in the state of matter obtained very high validity and were effective in increasing student learning activities[10]. Another study by Lestari and Wibowo on ecosystem learning for fifth-grade students also reported that CTL-based worksheets were highly valid, practical to use, and effective in improving students' observation skills as well as their ability to draw independent conclusions[11].

In support of this, research in BIOTIK: Jurnal Ilmiah Biologi Teknologi dan Kependidikan emphasizes the importance of innovative learning media in science education. Oviana found that contextual, student-centered learning with varied visual and interactive materials can improve students' scientific thinking and engagement. The study shows that well-designed instructional media aligned with students' real-life experiences enhance conceptual understanding and learning motivation. This strengthens the rationale for developing CTL-based worksheets that are valid, practical, and effective in improving learning outcomes.[12].

Based on this description, innovation in the development of teaching materials that can address the needs of contextual learning and strengthen learning independence at SDN 61 Seluma is needed. Therefore, this research focuses on the development of Contextual Teaching and Learning (CTL)-based student worksheets on ecosystems to foster student learning independence. This research is expected to produce valid and practical LKPD products and can be an alternative solution in improving the quality of science learning in elementary schools.

2. Research Method

a. Type of Research

The type of research used is (Research and Development/R&D). The development model used is the ADDIE model, which consists of five stages, namely Analysis, Design, Development, Implementation, and Evaluation[11].

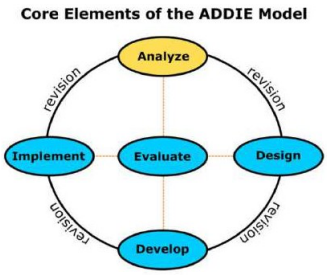

Figure 1. ADDIE Model Development Design

b. Time, Place, and Research

1. Research Time

This research will be carried out from January 2025 until the research is declared complete.

2. Research Site

This research will be conducted at SD Negeri 61 Seluma, which is located in Dusun Baru Village, Seluma District, Seluma Regency, Bengkulu Province.

c. Population and Sample

1. Population

The population of this study was all 5th-grade students at SD Negeri 61 Seluma, a total of 23 students, consisting of 15 boys and 8 girls. This population was selected based on the consideration that 5th-grade students at the school have thoroughly studied ecosystems material according to the curriculum[14].

2. Sample

This study sample involved 5th-grade students at SD Negeri 61 Seluma as the primary subjects. Product testing was conducted through several stages: a limited trial and a broad trial. In the limited trial stage, the study involved 8 students to assess the clarity of instructions, the attractiveness of the presentation, and the implementation of the worksheets. Subsequently, a field trial was conducted in two classes to obtain data on effectiveness and student responses[15].

d. Research Procedures

The study used the ADDIE model, starting with the analysis stage to identify learning problems through observation, interviews, and curriculum review. The design stage then produced the initial LKPD draft, including its structure, activities, and instruments, followed by the development stage where the LKPD was validated by experts and revised accordingly.The implementation stage involved applying the LKPD in classroom learning and observing student responses. Finally, the evaluation stage assessed the validity, practicality, and effectiveness of the LKPD through both formative and summative evaluation [16].

e. Data collection technique

This study used interviews, documentation, and questionnaires for data collection. Interviews explored science learning implementation, needs, and challenges related to CTL-based LKPD on ecosystem material. Documentation provided supporting data such as syllabi, lesson plans, learning outcomes, and activity photos. Questionnaires collected validation and response data from experts, teachers, and students using a Likert scale. These methods ensured comprehensive and valid data for LKPD development [17].

f. Data Collection Instruments

This study used questionnaires and checklists to assess the feasibility and practicality of CTL-based LKPD on ecosystem material. The instruments were given to material experts, media experts, teachers, and students. Their development was based on learning media theory and the R&D approach, focusing on validation, feasibility testing, and user responses [18].

1. Subject Matter Expert Validation

Table 1. Material Expert Validation Instrument

No	Likert Scale	Indicator	Aspects (1–5)
1	Content Suitability	Material aligned with learning outcomes, integrates ecosystem concepts, supports student independence and reflection.	1–5
2	Presentation Clarity	Logical sequence, easy-to-understand language, explanations related to ecosystem phenomena.	1–5
3	Conceptual Integration	Activities encourage critical and reflective thinking, prompt questions, and inquiry activities.	1–5
4	Meaningfulness and Relevance	Contextual material fosters environmental awareness and provides meaningful learning experiences.	1–5

Source: Arsyad, A. (2020). Media Pembelajaran (Revisi (ed.)). Rajawali Pers.

2. Media Expert Validation

Table 2. Media Expert Validation Instrument

No	Likert Scale	Indicator	Aspects (1–5)
1	Design and Layout	Attractive design, ecosystem-appropriate illustrations, easy-to-read fonts	1–5
2	Technical & Visual Quality	Consistent images and colors, visuals support conceptual understanding	1–5
3	Deep Learning Integration	The design supports exploration and reflection, visualizations foster critical thinking	1–5
4	Interest & Cohesiveness	The design aligns with the objectives, visuals reinforce the material, and increase motivation	1–5

Sumber: Arsyad, A. (2020). Media Pembelajaran (Revisi (ed.)). Rajawali Pers

g. Data analysis

Data analysis aims to process the results of expert validation, trials, and teacher and student responses to determine the feasibility, practicality, and effectiveness of CTL-based LKPD. Data were analyzed using descriptive percentages with the formula:

$$NP = \frac{R}{SM} \times 100\%$$

Information:
NP = percentage value
R = scores obtained
SM = maximum score
The percentage results are then interpreted using intervals:

$$i = \frac{\text{Highest score} - \text{Lowest score}}{\text{Number of interval classes}}$$

This analysis is used on expert validation data, teacher responses, and student responses to ensure that the developed LKPD is appropriate, interesting, and relevant for use in science learning at SD Negeri 61 Seluma.

h. Learning Independence Observation Sheet

Learning independence observation is used to collect data on students' levels of independence during learning using Contextual Teaching and Learning (CTL)-based worksheets. Observations are conducted directly by observers, focusing on students' actual behavior (observable behavior) in the aspects of initiative, self-confidence, responsibility, decision-making, and self-reflection[19].

The instrument is based on five indicators of learning independence: initiative and curiosity, self-confidence, responsibility for tasks, decision-making ability, and self-reflection. Each indicator is assessed on a scale of 1–4 with the following scoring categories: 1 = less independent, 2 = fairly independent, 3 = independent, and 4 = very independent. The total score ranges from 5–20 and is categorized as very

independent (17–20), independent (13–16), fairly independent (9–12), and less independent (≤8).

The data were analyzed descriptively quantitatively by calculating the average and percentage of learning independence achievements to determine the effectiveness of CTL-based LKPD in ecosystem learning.

2. Results and Discussion

The results of this study represent empirical findings from the research and development process in the form of Student Worksheets (LKPD) based on Contextual Teaching and Learning (CTL) on ecosystems material to train independent learning in elementary school students. The presentation of the results is arranged based on the stages of the ADDIE model, which include analysis, design, and development [20].

1. Analysis Stage

The analysis phase aims to identify learning needs, student characteristics, and the curriculum's suitability for developing CTL-based student worksheets (LKPD).

a. Needs Analysis

Observations indicate that fifth-grade science instruction at SD Negeri 61 Seluma is still dominated by lecture methods, with textbooks as the primary source. The LKPD used is conventional and focuses on low-level cognitive questions. This condition results in low student engagement and does not support contextual learning.

Students tend to be passive, waiting for teacher direction, and are not yet accustomed to reflecting on their learning. Teacher interviews revealed limited time and training as obstacles to developing innovative teaching materials. These findings indicate the need for CTL-based LKPD that can connect concepts to real life while fostering independent learning.

b. Analysis of Student Characteristics

Valentine's grade students tend to prefer learning activities based on direct experience, environmental observation, and simple discussions. However, their dependence on teachers remains high, and their ability to manage independent learning has not yet developed optimally. Therefore, learning tools that provide space for exploration, decision-making, and self-reflection are needed [21].

c. Curriculum and Material Analysis

Ecosystems material was chosen because it is relevant to the Science Learning Outcomes of Phase C of the Independent Curriculum and is easily contextualized through the surrounding environment. This material allows for the strengthening of science process skills and scientific reasoning, as well as the development of environmental awareness and independent learning [22].

Table 3. Science Learning Outcomes for Ecosystem Material Phase C

Elements	Learning Outcomes
Conceptual understanding	Understand ecosystems as a unity of biotic and abiotic components
Science process skills	Conduct simple observations and data presentations
Scientific reasoning	Explain relationships within ecosystems
Scientific attitudes	Demonstrate environmental awareness
Real-world application	Relate concepts to the surrounding environment
Learning independence	Plan and reflect on learning activities

Based on the analysis, it is necessary to develop LKPD based on CTL which is contextual and oriented towards independent learning.

2. Design Stage

The design stage produced the initial LKPD draft, including material, objectives, structure, and assessment instruments. The material covered ecosystem topics such as biotic–abiotic components, relationships among living things, food chains, and ecosystem balance, presented contextually. Learning objectives focused on identifying components, explaining food chains, relating concepts to real life, and fostering independence[23]. The LKPD structure followed CTL principles, consisting of identity, instructions,

problem context, inquiry activities, discussions, and reflection. The initial product was designed as a prototype with child-friendly visuals, observation activities, guiding questions, and reflection. Assessment instruments included validation sheets for experts and questionnaires for teachers and students to measure validity and practicality[24].

3. Development Stage

This stage produces the final LKPD product which has gone through an expert validation process.

a. Instrument Validation

Table 4. Instrument Validation Results

Instruments	Percentage	Criteria
Media expert validation	94%	Very valid
Material expert validation	92%	Very valid
Student questionnaire	93%	Very valid
Teacher questionnaire	93%	Very valid

All instruments are in the very valid category so they are suitable for use.

b. LKPD Design Validation

Table 3. Design Validation Results by Media Experts

Indicators	Max Score	Max Score
Display design	57	60
Visual quality	54	60
CTL integration	54	60
Media appeal	58	60
Total	225	**240**

The eligibility percentage reached 94% (very valid). The validator recommends:

1) addition of a table of contents
2) page numbering
3) refinement of the language and editorial content

Revisions have been made so that the LKPD is declared suitable for the implementation stage.

4. Implementation Stage

The implementation phase applied CTL-based worksheets on ecosystem material to 41 fifth-grade students. Results showed very high practicality, with student responses averaging 94.5% and teacher responses 95%. Observations indicated that students achieved an independent learning category with positive improvement. Overall, the worksheets were easy to use, engaging, and effective in increasing participation and learning independence [25].

5. Evaluation Stage

The evaluation phase was conducted formatively at each ADDIE stage and summatively after trials to assess the validity, practicality, and effectiveness of CTL-based LKPD in fostering independent learning on ecosystems, based on expert validation, questionnaires, and observations. In the analysis stage, students were still teacher-dependent and materials lacked context; the design stage evaluated indicators, CTL structure, and independence instruments; the development stage confirmed LKPD validity with revisions in concept, layout, and presentation; and the implementation stage showed high practicality, independent learning levels, and positive responses. Overall, the LKPD met validity, practicality, and effectiveness criteria and was suitable for science learning.

The LKPD was categorized as highly valid by material and media experts, indicating appropriateness in content, presentation, language, and graphics, and relevance to elementary science learning needs. Material validity was reflected in alignment between objectives, indicators, and systematically presented ecosystem content connected to real-life contexts, consistent with CTL principles[20]. From a constructivist view, LKPD facilitated active learning through observation, discussion, and analysis, emphasizing discovery processes [17]. Integration of CTL components—constructivism, inquiry, questioning, learning community, modeling, reflection, and authentic assessment—strengthened validity by promoting exploration, critical thinking, and reflection [18]. Learning independence was

embedded through activities such as observing, concluding, and reflecting, supporting self-regulated learning [19].

From a media aspect, LKPD met graphic design principles with clear layout, appropriate fonts, and relevant illustrations that enhanced understanding and motivation [20]. Language was adapted to students' cognitive levels and followed proper Indonesian rules, supporting comprehension [21]. Overall, validation confirmed feasibility and reinforced the relevance of contextual learning in improving learning quality.

The LKPD was also highly practical, shown by ease of use, clear instructions, and systematic steps [22]. Students could follow activities without difficulty, increasing motivation and engagement through real-life learning experiences [23]. Teachers found LKPD helpful for structured and efficient instruction, as well as facilitating discussions [24]. Reflection activities further supported understanding and independence [25]. Thus, LKPD proved practical, engaging, and effective in promoting meaningful learning.

Implementation in two classes (41 students) showed consistent results, with both classes achieving independent learning categories (average scores 15 and 14). This aligns with self-regulated learning theory, where students develop the ability to plan, monitor, and evaluate their own learning through active CTL-based activities.

3. Conclusion

Based on the research findings, the Contextual Teaching and Learning (CTL)-based LKPD on ecosystem material is categorized as highly valid. This is shown by validation results from media experts at 94%, material experts at 92%, and instrument validation above 92%, indicating that the LKPD meets the aspects of content feasibility, presentation, language, visual design, and integration with the CTL approach. In terms of practicality, the LKPD is considered very practical with positive responses from students and teachers. The average response in the limited test reached 93%, while in the broader test, Class A obtained 95% and Class B 94%, with an overall average of 94.5%.

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These results show that the LKPD is easy to use, attractive, and suitable for science learning on ecosystem material. Regarding effectiveness, the LKPD has been proven to improve students' learning independence. During implementation, students were able to complete tasks independently, participate actively in discussions, take responsibility for learning activities, and carry out reflection. Overall, the CTL-based LKPD is valid, practical, and effective, making it appropriate for use as contextual science teaching material in elementary schools.

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