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E-LKPD Innovation Based on Ethnoscience Material for Making *Ledre* Food Typical of Bojonegoro Elementary School Students

Inovasi E-LKPD Berbasis Etnosains Materi Pembuatan Makanan *Ledre* Khas Bojonegoro untuk Peserta Didik Sekolah Dasar

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Abstract

This research aims to develop ethnoscience-based E-LKPD products on the material of making typical Bojonegoro ledre for elementary school students. The utilization of local culture through the process of making ledre as ethnoscience-based learning media integrated with digital technology has great potential in supporting the success of the learning process. The research method used is the research and development model of Borg and Gall, which includes: initial data collection through observation and interviews for needs analysis; planning and designing the E-LKPD structure; developing the initial prototype; validation by material and media experts; product revision; small group trials; final revision; and field trials. The validation results showed that the feasibility of E-LKPD obtained an average score from media experts of 96.4% (very valid) and responses from teachers of 98.2% (very valid). Thus, the product is declared feasible to use as learning support at SDN 1 Sobontoro. Ethnoscience-based E-LKPD on the material of making typical Bojonegoro ledre is proven to be valid, practical, and feasible for use in the learning process of students. This study recommends the development of similar media for other grade levels and different local wisdom-based materials.

Keywords: *E-LKPD, ethnoscience, Bojonegoro ledre making, elementary school.*

Abstrak

Penelitian ini bertujuan untuk mengembangkan produk E-LKPD berbasis etnosains pada materi pembuatan *ledre* khas Bojonegoro untuk peserta didik sekolah dasar. Pemanfaatan kebudayaan lokal melalui proses pembuatan *ledre* sebagai media pembelajaran berbasis etnosains yang terintegrasi dengan teknologi digital memiliki potensi besar dalam mendukung keberhasilan proses pembelajaran. Metode penelitian yang digunakan adalah model penelitian dan pengembangan dari *Borg and Gall*, yang meliputi: pengumpulan data awal melalui observasi dan wawancara untuk analisis kebutuhan; perencanaan dan perancangan struktur E-LKPD; pengembangan prototipe awal; validasi oleh ahli materi dan media; revisi produk; uji coba kelompok kecil; revisi akhir; serta uji coba lapangan. Hasil validasi menunjukkan bahwa kelayakan E-LKPD memperoleh skor rata-rata dari ahli media sebesar 96,4% (sangat valid) dan tanggapan dari guru sebesar 98,2% (sangat valid). Dengan demikian, produk dinyatakan layak digunakan sebagai penunjang pembelajaran di SDN 1 Sobontoro. E-LKPD berbasis etnosains pada materi pembuatan *ledre* khas Bojonegoro terbukti valid, praktis, dan layak untuk digunakan dalam proses pembelajaran peserta didik. Penelitian ini merekomendasikan pengembangan media serupa untuk jenjang kelas lain dan materi berbasis kearifan lokal yang berbeda.

Kata Kunci: E-LKPD, etnosains, pembuatan *ledre* khas Bojonegoro, sekolah dasar.

1. Introduction

Education in the modern era continues to transform along with the times, especially in entering the era of the Industrial Revolution 5.0. The utilization of digital information and communication technology in learning, especially at the primary school level, is essential as a means of building high-quality human resources (Nuhiyah et al., 2024). In response to these challenges, the Ministry of Education and Culture (2020) has launched a number of digital learning platforms such as Rumah Belajar, Merdeka Mengajar, Akses Kelas, and Sekolah-MU, which can be accessed via smartphone devices. This convenience provides opportunities for students to study learning materials whenever and wherever they are (Kusuma et al., 2022).

However, the utilization of digital technology in learning has not been implemented evenly. Based on the results of preliminary observations at SDN 1 Sobontoro, Balen District, Bojonegoro Regency, it is known that the learning process is still dominated by a conventional approach oriented towards the use of textbooks and the lecture method (Enggrita et al., 2022). This approach has not been able to foster the active participation of students in the learning process. This condition is exacerbated by the unavailability of interactive learning media that can present meaningful and contextual learning experiences.

The learning media used tends to be less innovative, which has an impact on the low effectiveness of learning, especially in Class III of SDN 1 Sobontoro. According to Magdalena et al. (2021), innovative learning tools are essential in supporting learning effectiveness, especially for primary-level students. One solution that can be applied is the use of E-LKPD (Electronic Learner Worksheet) as an engaging and interactive evaluation tool. Prabowo's research (2021) shows that the use of technology-based worksheets has a significant impact on improving student learning outcomes.

Seeing these problems, E-LKPD is one of the potential teaching materials that has not been optimally utilized. E-LKPD can encourage learning based on exploration, visualization, and active participation of students. In this context, there is an urgency to develop learning models that are not only technologically innovative, but also relevant to the social and cultural context of learners. A number of studies have discussed the development of E-LKPD such as (Hanum & Amini, 2023; Prastika & Masniladevi, 2021; Suryaningsih & Nurlita, 2021; Wahyuni et al., 2021). Likewise, discussions about ethnoscience such as (Novanda et al., 2024; Pratiwi,2021; Septiaahmad et al., 2020). However, this research is unique because it was conducted contextually at SDN 1 Sobontoro based on the real needs in the field.

An ethnoscience-based learning approach is considered appropriate to utilize the richness of local cultures, such as the process of making traditional *ledre* food typical of Bojonegoro, as a learning context on the theme "Get Acquainted with Energy." This approach is believed to increase students' contextual connection to the material being studied and foster a sense of love for local culture (Suryanti & Widodo, 2024).

The urgency of developing innovative learning media based on ethnoscience lies in the importance of creating a learning process that is contextual, adaptive, and rooted in local culture. The absence of learning media that is relevant to the social environment of students causes learning to be meaningless, lack of interest in learning, and inhibits indepth mastery of concepts. In addition, conventional approaches that continue to be maintained without technology-based updates and local wisdom have the potential to widen the gap between 21st century learning needs and factual conditions in the classroom. Therefore, the development of ethnoscience-based E-LKPD is not only a pedagogical alternative, but is an urgent need in answering the challenges of digital century learning that still respects regional cultural values.

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2. Literature Review

Previous research by Nurhayati et al. (2022) developed a student worksheet (LKPD) based on the local wisdom of Bojonegoro's traditional batik motifs, aimed at elementary school students. The development process adopted the Four-D (4D) model. Beyond product development, the study also examined the effect of the LKPD on students' critical thinking skills using a one-group pretest-posttest design. The results indicated that the LKPD was highly feasible for classroom use, with an average score of 89, and effectively enhanced students' critical thinking abilities. This study underscores the significance of incorporating local wisdom into instructional materials, as it stimulates student interest by presenting content that is closely tied to their cultural environment.

Building upon this idea, Fitriani et al. (2024) designed an ethnoscience-based E-LKPD for learning about ecosystems, targeting fifth-grade elementary school students. The study employed the ADDIE model and emphasized the integration of local wisdom into digital learning media to foster contextual understanding and learner engagement. The validation phase resulted in an average score of 89%, indicating that the product was highly feasible. Furthermore, trial implementation showed that the E-LKPD was effective in improving students' learning motivation, critical thinking skills, and appreciation of local culture. This research reinforces the value of digital-based learning tools that merge scientific content with students' socio-cultural context.

In line with these findings, a number of other studies have explored the development of E-LKPD to support innovative and effective learning. Hanum and Amini (2023) developed a problem-based learning E-LKPD using the Book Creator application for third-grade elementary students. Prastika and Masniladevi (2021) created an interactive E-LKPD on regular and irregular polygons using Liveworksheets to improve learning outcomes for fourth-grade students. Suryaningsih and Nurlita (2021) emphasized the importance of innovative E-LKPD in promoting 21st century skills, while Wahyuni et al. (2021) designed a HOTS-based E-LKPD for thematic learning at the elementary level. These studies collectively demonstrate the growing trend and potential of E-LKPDs in enhancing educational quality through technological and pedagogical innovation.

aBased on the aforementioned studies, it is evident that the integration of local culture into digital learning media is not only relevant but also impactful in the learning process. Amid the rapid advancement of globalization and technology, elements of local wisdom are increasingly marginalized. Therefore, introducing science through a cultural lens that resonates with students' daily lives can make learning more meaningful while fostering cultural awareness and scientific thinking. In response to this need, the present study proposes an innovative ethnoscience-based E-LKPD focusing on the traditional ledre making process of Bojonegoro. This approach aims to combine digital tools, local culture, and science education contextually for elementary school learners.

3. Research Methods

3.1 Type of Research

Research and Development (R&D) is a systematic process used in developing and testing an educational product in the form of new models, media, teaching materials, or techniques. The primary purpose of R&D in education is to bridge the gap between theory and practice by

designing and validating educational products that are effective, practical, and contextually relevant (Erlinda et al., 2025).

This research aims to produce a product, namely E-LKPD teaching materials, that can facilitate students in the learning process. This R&D procedure uses the Borg and Gall model, where this model has a high level of feasibility and validity of a product and is continuous, which means that the product can continue to innovate and continue (Anggermawan et al., 2024). Therefore, to produce a quality research and development product that can be accounted for, this study used 10 research steps developed by Borg and Gall, but limited costs, limited research time, and the scope of the research scale is small. So, the researcher modified it by doing 8 steps of research and development with more clarity as follows:

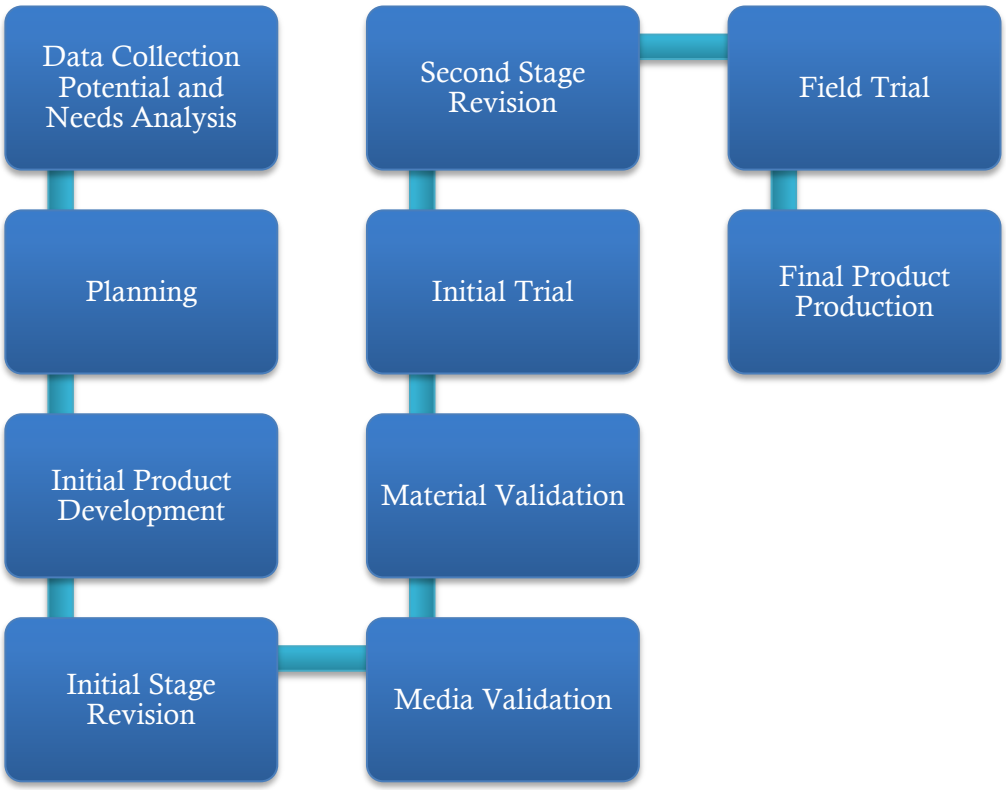

Figure.1. Borg and Gall Development Adaptation Model

3.2 Research Subjects and Locations

The research subjects used all third-grade students of SD Negeri I Sobontoro Kec. Balen, Kab. Bojonegoro school year 2024/2025, totaling 30 students. The research was carried out at SD Negeri Sobontoro I, Balen District, Bojonegoro Regency.

3.3 Data Collection

This step is the collection of research data, namely by exploring resources and problems. This step is an activity that includes potential, needs analysis, interviews, and initial classroom observations. So that the problems encountered in learning can be identified, as well as collecting initial data on the supporting and inhibiting factors of learning, then proceed with E-LKPD planning and validation by experts and teachers to get feedback as a reference for product improvement. Product improvements that have been made are carried out in initial product trials involving 10 respondents of grade 3 students to get suggestions for product improvement after use.

P-ISSN : 1693-2226
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After the improvement of the E-LKPD, the field test was continued, involving 30 student respondents, to assess the E-LKPD used.

3.4 Research Instruments

This step is a measuring tool chosen and used by researchers to collect data systematically and comprehensively. The purpose of the research instrument is to obtain comprehensive data to determine the feasibility of teaching materials that have been developed.

Table.1. Media, Expert & Teacher Feasibility Instruments

Assessment	Indicator Statement	Statement Number
Attractiveness	Clarity of cover writing	1-5
	Attractiveness of cover layout	
	Material descriptions are neat and systematic.	
	Background and text color combinations are relevant.	
	Appropriate use of font size and type	
Practicality	Clarity of sentence structure in E-LKPD	6-12
	E-LKPD has been adapted to learning outcomes	
	E-LKPD facilitates students to learn independently	
	Clear instructions for using E-LKPD	
	Suitability with learning outcome achievement indicators	
	Suitability of E-LKPD to the needs of students	
	Clarity of cover writing	

Table.2. Media Feasibility Instrument, Student Response

Assessment	Indicator Statement	Statement Number
Attractiveness	I easily understand the material	1-7
	The sentences in the E-LPD are easy for me to understand	
	The background color is correct.	
	The use of animation in E-LKPD is not excessive.	
	The font size of the text is precise.	
	E-LKPD is very fun to use	
	The colors and animated images on the display are attractive and clear.	
Practicality	I am a to-read text	8-14
	Available images make it easier to understand the learning material.	
	Learning becomes more interesting.	
	The exercise questions in the E-LKPD are easy to understand.	
	E-LKPD is not easy to crash/hank	
	Buttons function as intended.	

	Feeling helped by the E-LKPD for independent learning.

3.5 Data Analysis Technique

The questionnaire sheet used to measure this E-LKPD uses a Likert scale with assessment criteria carried out by experts, teachers, and students. The selection of a Likert scale with 4 answer options is based on its advantages that can capture research data more accurately with answers containing positive statements. The following method was used to process quantitative data from the pilot test subjects:

$$P = \frac{\Sigma}{\Sigma \times 1} \text{X}100\%$$

Description:
P = Average percentage
∑ = Number of respondents' score answers
∑x1 = The number of ideal answers to an item
100 % = Constant

The parameters of achievement in this research and development with the following guidelines:

Table.3. E-LKPD Validity Parameters

Level	Classification	Description
85 % - 100%	Highly Valid	Without revision
70 % - 84 %	Valid	Without revision
55 % - 69 %	Valid Enough	Revised
50 % - 54 %	Less Valid	Revised
0 % - 49 %	Not Valid	Revised

4. Results and Discussion

4.1. Research Results

The results obtained from this study are E-LKPD products as ethnoscience-based contextual learning tools to support the effectiveness of student learning, using the adapted Borg and Gall model. The steps taken in this research include Data Collection, Planning, Initial Product Development: Material Expert Validation, Media Expert Validation, Initial Stage Revision, Initial Trial, Second Stage Revision Field Trial, and Final Product Production. The scope of this study is elementary school-level students, so the selection of materials and products developed is adjusted to the needs of the analysis conducted on them.

The data collection stage is carried out to explore potential and analyze needs. Furthermore, the E-LKPD product planning is designed using the UI/UX figma platform, then designed using the unity engine with product visualization see Figure 2.

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E-ISSN : 2303-2219

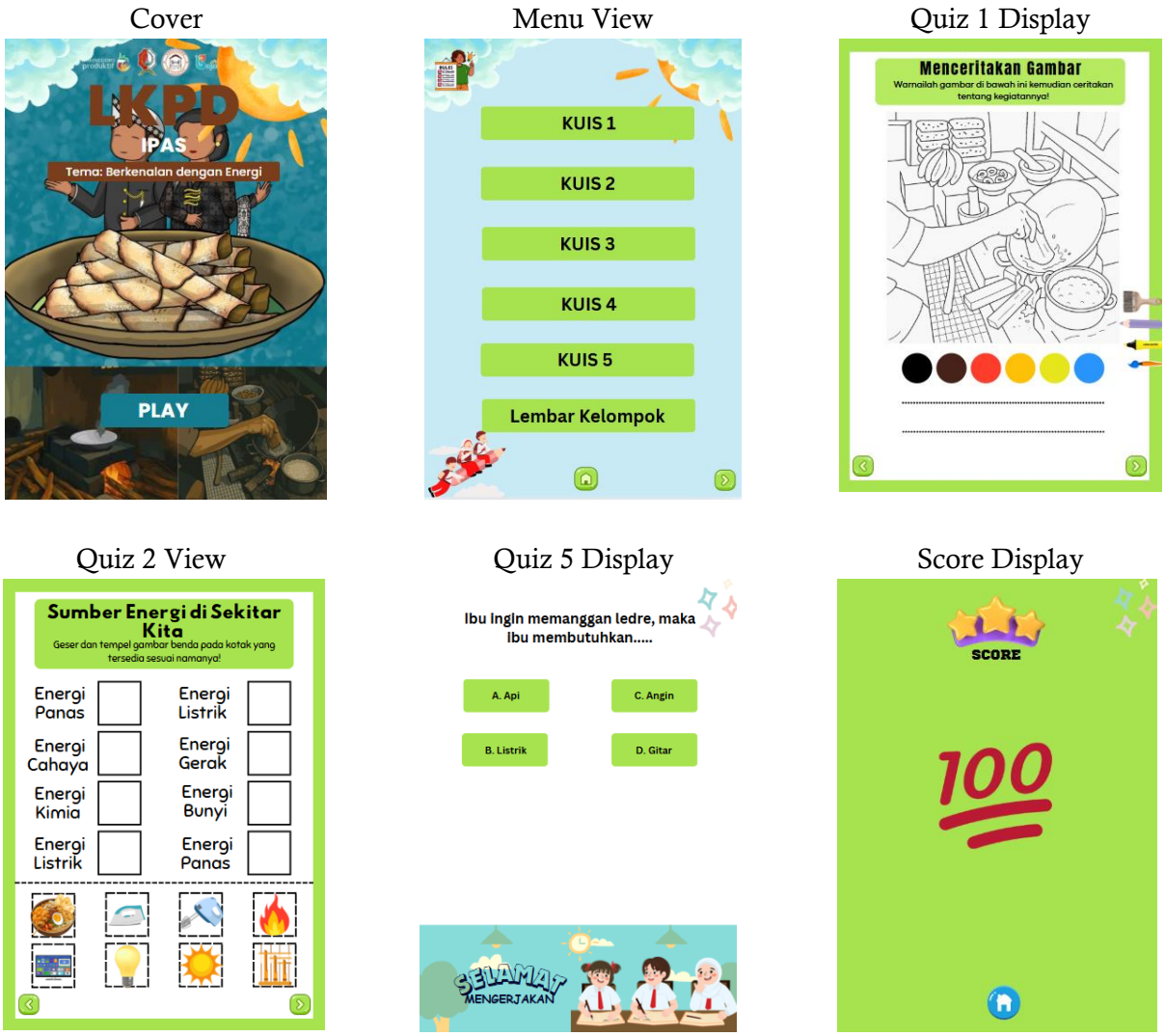

Figure.2. E-LKPD Product Results

Media experts and teachers carried out the validation stage, and it was taken from a Likert scale questionnaire 1-4. There were several inputs and revisions, so improvements were needed to improve product quality. Based on the questionnaire that was distributed to media experts, the validation score touches 96.4%, and the teacher touches 98.2, so it is suitable for testing but has some notes see Table 4. From the validation results that have been obtained, the author made initial stage revisions, especially in the visual appearance and content quality section, see Figure 3.

Table.4. Media, Expert & Teacher Feasibility Instruments

Assessment	Indicator Statement	Classification			
		Media Expert		Teacher	
		Score	Percentage (%)	Score	Percentage (%)
Attractiveness	Clarity of cover writing	4	100	4	100
	Attractiveness of cover layout	4	100	4	100

	Material descriptions are neat and systematic	3	75	4	100
	Background and text color combinations are relevant	4	100	4	100
	Appropriate use of font size and type	4	100	4	100
Practicality	Clarity of sentence structure in E-LKPD	4	100	4	100
	E-LKPD has been adapted to learning outcomes	4	100	4	100
	E-LKPD make it easier for students to learn independently	3	75	3	75
	Clear instructions for using E-LKPD	4	100	4	100
	Suitability with learning outcome achievement indicators	4	100	4	100
	Suitability of E-LKPD to the needs of students	4	100	4	100
Total Acquisition		54	96,4	55	98,2

Table.5. Product Improvement Feedback

Respondents	Improvement Feedback
Media Expert	1. The initial display of E-LKPD added a play button 2. Adding Learning Outcomes
Teacher	1. Change the UI/UX of quiz 4 from number sort to number shift 2. Add a number button

Before Revision

After Revision

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E-ISSN : 2303-2219

Figure.3. Revised Product Section

After making revisions, the improved product was carried out with an initial trial involving 10 students to get feedback. This trial aims to provide researchers with feedback and evaluation. Thus, the results of the evaluation of the feasibility of E-LKPD in supporting the learning process of students with the material of making typical Bojonegoro ledre food. Feedback from this trial is important to know the extent to which the product is accepted and to see the feasibility of a larger group of students.

Table.6. Acquisition of the Initial Trial Learner Response Questionnaire

Assessment	Indicator Statement	Classification		
		Score	Percentage (%)	Category
Attractiveness	I easily understand the material	31	77,5	Valid
	The sentences in the E-LKPD are easy for me to understand	32	80	Valid
	The background color is correct.	33	82,5	Valid
	The use of animation in E-LKPD is not excessive	31	77,5	Valid
	The font size of the text is clear	32	80	Valid
	E-LKPD is very fun to use	34	85	Highly Valid

	The colors and animated images on the display are attractive and clear	34	85	Highly Valid
Practicality	I am a to-read text	34	85	Highly Valid
	Available images make it easier to understand the learning material	33	82,5	Valid
	Learning becomes more interesting.	32	80	Valid
	The exercise questions in the E-LKPD are easy to understand.	32	80	Valid
	E-LKPD is not easy to crash/hank	33	82,5	Valid
	Buttons function as intended.	30	75	Valid
	Feeling helped by the E-LKPD for independent learning.	28	70	Valid
	Total Acquisition	449	80,2	Valid

The results of this initial group trial can be seen in Table 4. Based on the results of the initial trial, the average presentation result was 80.2% (Valid). See Table 4 to see the effectiveness of E-LKPD products in improving student learning outcomes, it is necessary to conduct further trials in the field test. This trial was conducted to see the acceptability and feasibility of using the product for elementary school students and to see its effectiveness. The output of the field trial that was carried out obtained an average result of 93.2% (Very Valid) (see Table 6). These results indicate that this product is very Valid and shows effective results to support the learning process.

Table.7. Acquisition of Response Questionnaire for Field Test Learners

Assessment	**Indicator Statement**	**Classification**		
		Score	**Percentage (%)**	**Category**
Attractiveness	I easily understand the material	112	93,3	Highly Valid
	The sentences in the E-LKPD are easy for me to understand	110	91,7	Highly Valid
	The background color is correct.	116	96,7	Highly Valid
	The use of animation in E-LKPD is not excessive	117	97,5	Highly Valid
	The font size of the text is clear	115	99,2	Highly Valid
	E-LKPD is very fun to use	119	90,8	Highly Valid
	The colors and animated images on the display are attractive and clear	109	95	Highly Valid
Practicality	I am a to-read text	114	92,5	Highly Valid
	Available images make it easier to understand the learning material	111	90,8	Highly Valid
	Learning becomes more interesting.	109	87,5	Highly Valid
	The exercise questions in the E-LKPD are easy to understand.	105	91,7	Highly Valid
	E-LKPD is not easy to crash/hank	110	86,7	Highly Valid

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	Buttons function as intended.	104	85,8	Highly Valid
	Feeling helped by the E-LKPD for independent learning.	115	99,2	Highly Valid
	Total Acquisition	1566	93,2	Highly Valid

4.2. Discussion

Ethnoscience-based E-LKPD products are made using the material of typical Bojonegoro *ledre* food for IPAS subjects tailored to SDN 1 Sobontoro students. This teaching material is a means for students to foster students understanding of local wisdom and how energy affects the making of *ledre* food. E-LKPD functions as a supporting tool designed with a specific structure that includes a summary of the subject matter, which is then accompanied by a series of questions intended as exercises to facilitate a better learning experience (Firtsanianta & Khofifah, 2022; Putra & Agustiana, 2021; Suryaningsih & Nurlita, 2021). This E-LKPD aims to motivate learners to connect concepts that learners have previously acquired, engage in elaboration skills exercises, critical thinking skills, and articulate their thoughts and ideas effectively (Puspita & Dewi, 2021; Putra & Agustiana, 2021).

Innovation of ethnoscience-based E-LKPD on the material of making typical Bojonegoro *ledre* food in IPAS subjects, formulated from various problems that exist in the field. Based on observations, it was found that students of SDN 1 Sobontoro did not understand their local wisdom. This lack of understanding can be caused by various factors, including limited learning resources about local wisdom around students (Jamaah et al., 2024; Lasari, 2024). As a result, learners have not been able to appreciate the importance of local wisdom, traditional knowledge, and values that shape the identity and cohesion of the communities around learners. As a means of bridging this gap, it is imperative to implement innovations such as E-LKPD that emphasize the importance of Bojonegoro's typical local wisdom, encouraging learners to engage with local wisdom such as *ledre* making. In addition, it is expected that the E-LKPD can make students better understand the material of energy sources around them contextually. This is because in the E-LKPD, the Bojonegoro *ledre* material is connected to how various energy sources can affect the making of *ledre*.

This research uses the Borg and Gall model systematically to produce products that are valid and feasible to use. The resulting product is in the form of E-LKPD, which integrates material for making typical Bojonegoro *ledre* food. This E-LKPD provides not only general text features but also various features, including coloring and illustrations that describe the steps of making the developed *ledre* and multiple-choice questions where students can find out the score directly. In addition, the use of E-LKPD is also combined with cooperative learning models, such as problem-solving exercises and case studies, encouraging critical thinking and understanding local wisdom and IPAS materials.

Based on the first research and development objective, namely producing E-LKPD products that are feasible by fulfilling the elements of validity with aspects of attractiveness and practicality. E-LKPD products that researchers have developed have fulfilled these elements after going through the validation stage by media experts, with a percentage of 96.4% in the "very Valid" category, and the validation stage by teachers, with a percentage of 98.2% in the "very Valid" category. Then, the E-LKPD product has been revised based on the suggestions and comments of the two validators. First, the initial appearance of the E-LKPD added a play button and added learning outcomes. Second, changing the ui/ux of quiz 4 from sorting numbers to sliding numbers and adding a number button. Validation by experts results in the E-LKPD product being developed

as "suitable for use with revision." Then, the E-LKPD was revised and conducted an initial trial on elementary school students. The results of the trial showed 80.2% with a "Valid" category that all elements of the E-LKPD were considered valid and could be continued to the next stage. This is also reinforced by the statement by Yessi (2021) that well-designed learning media can improve and encourage learning and support the learning process between teachers and students.

The next stage, namely the field trial, obtained a result of 93.2% with the category "very Valid," this is based on the acquisition of student questionnaire data on the aspects of attractiveness and practicality aspects so that the E-LKPD product is suitable for use in the learning process. This trial process not only includes a thorough review of the content for accuracy and relevance, but also an assessment of the pedagogical strategies used in the E-LKPD to ensure its alignment with learning practices in the IPAS subject. This is also supported by the opinion of Wulandari et al. (2023) that appropriate learning media is beneficial to learners in the learning process teaching. The use of learning media can help teachers in explaining the learning material to be delivered. In addition, integrating E-LKPD with ethnoscience using cooperative learning models empirically supports the learning process of students (Hidayati & Darmuki, 2022; Iftinannisa et al., 2024; Ningsih, 2022; Sagita et al., 2020). This learning model has students actively participating during discussion activities, both individually and in groups.

The implementation of the research has obstacles, namely the difficulty in integrating ethnoscience values into teaching tools that are suitable for elementary school materials. This process requires the right pedagogical approach so that the material not only contains local cultural values, but also contains the content of science concepts that are intact and can be understood by students. Then, the preparation of E-LKPD requires foresight in simplifying language and illustrations to match the characteristics of students' cognitive development. In addition, technical barriers are also a challenge, especially related to the digital literacy of learners and teachers. Not all learners and teachers are accustomed to using digital learning media, so assistance is needed so that E-LKPD can be used optimally.

5. Conclusion

This study successfully designed and developed ethnoscience-based E-LKPD on the material of making typical Bojonegoro *ledre* for elementary school students to improve the effectiveness of the learning process, using the Borg and Gall model. Includes Data Collection, Planning, Initial Product Development: Material Expert Validation, Media Expert Validation, Initial Stage Revision, Initial Trial, Second Stage Revision Field Trial, and Final Product Production carried out in the development stage. The validation results show that the results meet the eligibility criteria, with the category "very Valid" used with revisions. Field trials of E-LKPD products obtained favorable responses from students in supporting the learning process.

The integration of the ethnoscience approach in the form of E-LKPD for making typical Bojonegoro *ledre* makes it contextually relevant to the lives of students, especially the learning theme of getting acquainted with energy. This approach not only strengthens the concept of science with the environment of learners but is able to increase motivation, learning outcomes, and learning effectiveness through digital interactive features that have been adapted to 21st century learning needs. For further research, it can examine the context of local wisdom in different regions to measure its effectiveness, then can add AR (Augmented Reality), VR (Virtual Reality), and other latest features to enrich the learning experience of learners.

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