The Effectiveness of Ethnoscience-Based Electronic Student Worksheet to Improve Critical Thinking and Scientific Literacy in Middle School Students

Erlina Kusnul Kotimah[1*], Woro Sumarni[1], Arif Widiyatmoko[1], Agung Tri Prasetya[1], Ani Rusilowati[1]

[1]Science Education Master's Study Program, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang, Semarang, Indonesia.

Abstract: Critical thinking and scientific literacy must be cultivated and mastered by students in science learning in the 21st century. This research aims to determine the validity, feasibility, and effectiveness of increasing critical thinking and scientific literacy skills on ethnoscience-based electronic student worksheets developed focusing on additive material. The development of this ethnoscience-based electronic student worksheet followed the ADDIE model using mixed methods. Data collection methods included interviews, distribution of teacher and student questionnaires, tests, and documentation. The validity of ethnoscience-based electronic worksheets obtained a material validity value of 0.98 and a media validity value of 0.97, both of which met the valid and appropriate criteria. Ethnoscience-based electronic worksheets have been proven to be effective in increasing critical thinking competence with an N-Gain score of 0.86 and also effective in increasing scientific literacy competence with an N-Gain score of 0.87, both of which meet the high criteria. In summary, research on the development of an ethnoscience-based electronic student worksheet has been deemed to have a very high level of feasibility and validity and is highly effective in improving the critical thinking and scientific literacy of junior high school students.

Keywords: Critical Thinking; Electronic Student Worksheet; Ethnoscience Based; Science Literacy

Introduction

The rapid progress of science and technology in the 21st century has become a special characteristic where everything can be done easily with the help of technology (Pertiwi et al., 2019). The development of science and technology (IPTEK) in the 21st century in the era of industrial revolution 4.0 has had a major impact on the development and progress of technology in the world of education. The focus of expertise in the field of education is emphasized on education in the 21st century where students are focused on mastering and being proficient in 4C skills which include critical thinking, creativity, communication and collaboration so that Indonesian students can compete with global society now and in the future (Chiruguru, 2020; Septonanto et al., 2024; Wijanarko et al., 2024; Yokhebed, 2019; Zahroh & Yuliani, 2021; Zakiyah & Sudarmin, 2022). Modern skills such as critical thinking, creativity, collaboration and communication are very important to face the dynamics of an ever-changing and complex world (Wedy & Desnita, 2024). This includes skills such as creativity and problem solving that help students face the challenges of the 21st century (Bayley, 2022).

The 21st century is currently marked by the rapid development of various fields of science and

information technology. The use of information and communication technology in all aspects of life, including in the learning process, is one sign of changing developments in the 21st century (Nurvitasari, et al., 2020). The need for comprehensive knowledge in the field of education in the 21st century does not only mean education in the cognitive realm, but also includes values, perspectives and thought patterns that are developed to foster creative thinking and ethical skills (Tirri, 2016; Wang et al., 2018). Science learning in the 21st century aims to help students improve scientific literacy, critical thinking skills, the ability to apply what they have learned, and understand the nature of science (Sutrisna, 2021). The skills that need to be trained in students in the 21st century are critical thinking skills and scientific literacy.

Science learning provides a unique opportunity for students to do so develop various types of general skills such as skills critical thinking and scientific literacy (Parinduri et al., 2023). Critical thinking skills are one of the cognitive factors that influence scientific literacy competence where there is a fairly strong positive relationship between the two (Rahayuni, 2016). Critical thinking skills and scientific literacy are closely related and are considered very important for students to train in science learning in the 21st century. The level of scientific literacy that a person has helps develop critical thinking skills. The existence of a relationship between critical thinking skills and scientific literacy which has a positive and significant influence on each other, meaning that the higher the critical thinking skills, the higher the scientific literacy abilities of students (Kusumastuti et al., 2019; Naswar, 2023). This is because they are familiar with the activities of processing information, identifying strong arguments, understanding various different thought patterns, to be able to make policies in solving problems.

Critical thinking skills and local cultural awareness need to be developed in junior high schools through science learning, which are 21st century competencies that students must possess and master (Hikmawati et al., 2020). Critical thinking is a skill that requires rational participation in the science learning process, which involves interrelated elements in various situations, including analyzing evidence, reasoning, and developing a rational perspective as well as playing a role in the decision-making process to solve a problem through scientific investigation (Julian et al., 2020; Ruku & Purnomo, 2020; Yokhebed, 2019). Based on the results of previous research, it is revealed that critical thinking skills in several indicators are generally in the low category, this is due to students' lack of experience in dealing with learning that stimulates critical thinking competence (Salsabilla et al., 2024a). In addition, the use

of teacher-centered learning models and media means that students have less opportunity to develop their critical thinking skills.

Apart from critical thinking skills, scientific literacy also plays an important role in science learning in the 21st century. This scientific literacy can be measured internationally every three years through the PISA study conducted by the OECD (Organization for Economic Cooperation and Development). Since 2000, Indonesia began joining the PISA study, however, the scientific literacy competency of Indonesian students is still low, as seen from the assessment of the results of the PISA study from 2000 to 2019, which has decreased from 38th to 70th rank (OECD, 2018). This was stated by previous researchers that students' scientific literacy from year to year based on PISA study data is still low (Hikmawati et al., 2020; Junita & Yuliani, 2022; Kadaritna et al., 2020; W. J. Pertiwi et al., 2021; Rahayuni, 2016; Tiara & Sari, 2019). Scientific literacy supports students' ability to understand scientific concepts and processes and apply them in everyday life (Sutrisna, 2021; Yuliana et al., 2021).

Scientific literacy describes an individual's ability to understand laws, theories, scientific phenomena and many things (Dragos, 2015). Scientific literacy is an important competency for students to have because it helps them apply scientific understanding to make wise, rational decisions and pay attention to their impact on the environment. However, many factors can influence students' low scientific literacy, one of which is the selection of inappropriate and inadequate learning resources (Kristyowati & Purwanto, 2019; Siagian et al., 2022). The low level of students' science literacy skills shows that they lack the ability to think deductively and inductively. One appropriate way to increase these competencies is by integrating local cultural wisdom into learning materials (Dewi et al., 2021; Pertiwi et al., 2019).

Ethnoscience-laden material in learning has a positive influence on students if learning at school is in harmony with the everyday cultural knowledge being studied (Wijayanti et al., 2019). Science learning with an ethnoscience approach analyzed based on effect size can be a solution in improving and developing students' skills needed to face the challenges of this century (Nurhasnah et al., 2022). Ethnoscience learning is a new breakthrough in the world of education which integrates local wisdom in the community with scientific knowledge which will make learning more meaningful (Pertiwi et al., 2021; Widyaningrum, 2018; Yolida et al., 2023). Learning science (science) by linking the concept of local cultural wisdom within the community is proven to be able to grow and develop students' critical

thinking competencies (Falah et al., 2018; Hadi et al., 2019; Hikmawati et al., 2020; Purnamasari et al., 2021).

Therefore, to support increasing critical thinking competence and scientific literacy, one of the teaching materials is needed in the form of ethnoscience-based student worksheet. The use of ethnoscience-laden student worksheet in the learning process can increase students' critical thinking competence (Astari & Sumarni, 2020). Student worksheet teaching materials have certainly been developed by many teachers, the problem is that many science teachers do not integrate student worksheet with local cultural wisdom in their respective regions. In reality, it is true that many of the student worksheet presented by teachers are generally still ordinary, not yet based on local cultural wisdom in students' daily lives (Sari et al., 2018; Yolida et al., 2023).

As modern times develop, technology is increasingly being accessed electronically using the internet, necessitating changes to traditional student worksheets to electronic ones in learning. Electronic student worksheets provides opportunities for students to learn independently and makes it easier for teachers to build effective communication (Ayuni & Tressyalina, 2020). Electronic student worksheets are a learning alternative for students in the digital era because it contains various activities that can be done online. Electronic student worksheets is a form of teaching material that is systematically arranged into certain learning units which are presented in electronic format which includes animations, images, videos, navigation which makes users more interactive and can be accessed online with the program (Lathifah et al., 2021).

Electronic worksheets are a form of innovative teaching material that functions as a guide in learning activities by presenting summary materials, assignments and learning videos that are easily accessible (Chofifah & Wintarti, 2023). Learning is not monotonous because electronic student worksheets has several features such as videos, images and text (Nurafriani & Mulyawati, 2023). The features in electronic student worksheets are supported by connecting website pages in the form of images, videos and hyperlinks (Nurjanah & Trimulyono, 2022). The features contained in electronic student worksheets must be well designed to help students better digest learning material in the context of science in everyday life (Ariq & Fitrihidajati, 2021). The use of varied media in electronic student worksheets can increase students' curiosity and avoid boredom during learning (Farida et al., 2024). The development of digital worksheets is not only limited to elements but can also add videos and interesting phenomena (Kamal et al., 2024). Electronic student worksheets is packed with many interactive features such as images, moving animations, videos, sounds, and other forms of interactive questions that make learning easier today. Electronic student worksheets are digital-based learning media that can be accessed via laptop or smartphone, which contain material, images, videos and oral and written questions that can be answered at that time (Lioba et al., 2021; Shelviana et al., 2023; Sumanik, et al., 2023; Zahroh & Yuliani, 2021). Another advantage of using electronic student worksheets in learning is that it is more practical and flexible, saves time, is easy to access and can be done anywhere (I. Amalia et al., 2022).

Electronic student worksheets using the Liveworksheets application is a container for student worksheets created online with many feature elements provided. The development of electronic student worksheets which is packaged using the Liveworksheets website as a learning innovation that can be completed by students directly using either a laptop or smartphone (Junita & Yuliani, 2022). This live worksheet digital student worksheet can make it easier for teachers to direct students to study online by filling in answers directly on the website and the grades can be known by students and teachers. This Liveworksheets application makes it easy to convert traditional student worksheets into documents, such as PDF, JPG, and PNG, so that they can be converted into interactive electronic student worksheets that can automatically correct right and wrong answers (Wulandari et al., 2023). There are many advantages of student worksheets based on the live worksheet application is that it makes it easier for students to work on questions more efficiently because they can be done anywhere, saves time, and also provides various interesting feature elements or can be created by the teacher himself. Another benefit of using electronic student worksheets in Liveworksheets is that it saves space and time, makes it look attractive, is environmentally friendly because it is available digitally, is always available, has a compact design and large capacity, and is definitely efficient in reducing costs (Oktavianto & Aghni, 2022). These electronic student worksheets are presented interactively so that students can be more active in the learning process, and students can also use electronic student worksheets to repeat the material contained in them at any time and anywhere (Farida et al., 2024).

The development of innovative electronic student's worksheet is very important and needed by students to meet the demands of 21st century learning as teaching materials, practicums, overcoming boredom, technological developments and online learning (Suryaningsih & Nurlita, 2021). The benefits of developing ethnoscience-based electronic student worksheet which is equipped with audio-visual media and various learning features is very effective in training

students' scientific literacy skills (Junita & Yuliani, 2022). The development of ethnoscience-based electronic student worksheet on additive materials by introducing typical regional foods and drinks has not been widely developed in previous studies to improve students' critical thinking competencies and science literacy so that it becomes a novelty in this study.

Based on the initial needs analysis at SMPN 1 Negara, Lampung, the actual conditions show that students and science teachers have never used ethnoscience-based electronic student worksheet in learning. Based on these problems and needs analysis, research on the development of ethnoscience-based electronic student worksheet teaching materials is very necessary. This research is focused on developing ethnoscience-based electronic student worksheet on additive materials that are packaged by including the context of local cultural wisdom in traditional foods and drinks typical of Lampung province. This ethnoscience-based worksheet is expected to improve critical thinking skills and science literacy of junior high school students.

Method

This research uses ADDIE model (Analysis, Design, Develop, Implement, and Evaluate). The ADDIE method in this development research aims to determine the validity of the feasibility and effectiveness of increasing junior high school students' critical thinking and scientific literacy through the development of ethnoscience-based electronic student worksheet products on additive material. This ADDIE model has a very simple procedure but its implementation is systematic (Chofifah & Wintarti, 2023). The ADDIE model can be used in various kinds of development such as models, learning strategies, learning methods, media and teaching materials (Rachmawati et al., 2023; Wijaya et al., 2022). Developing ethnoscience-based electronic student worksheet uses the ADDIE model, which can be seen in Figure 1.
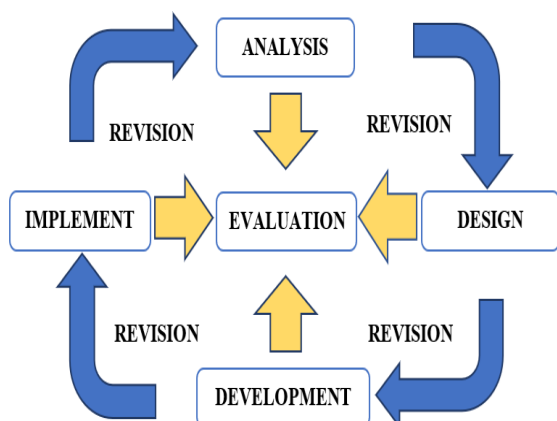

Figure 1. ADDIE Model Development Design

The implementation of ethnoscience-based electronic student worksheet teaching materials was given to one experimental group class of students in class VIII B at UPT SMPN 1 Negara Batin, Way Kanan district, Lampung province. The development research procedure carried out follows the steps of the ADDIE model. The scheme of the research procedure is presented in Figure 2.
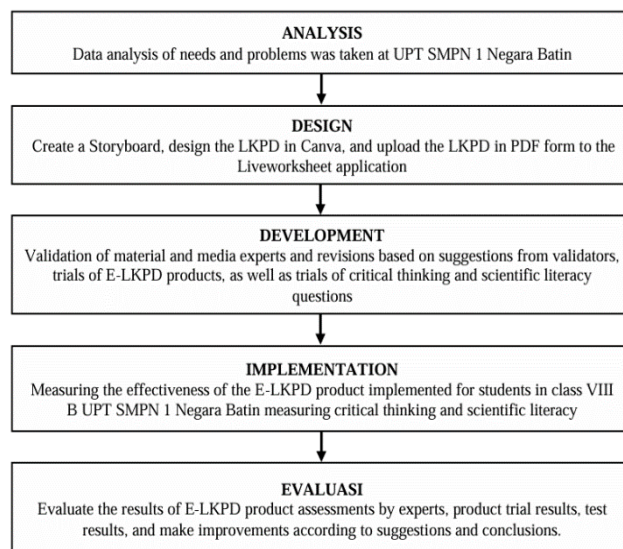

Figure 2. Development Scheme with the ADDIE Model

The implementation stage of this research used a quasi-experimental method (one-group pretest-posttest design). This research method uses one research class which is measured before (pretest) and after treatment (posttest). Data collection techniques in this research were tests and non-tests. The data collection method using non-test techniques in this research is in the form of interviews, distributing questionnaires, and documentation. Instrumental questions for critical thinking are made in the form of multiple-choice questions, and for scientific literacy are made in the form of essay questions. The data collection method uses test techniques in the form of pre-experimental tests (pretest) and post-experiment tests (posttest). Data collected in this development research includes the results of product expert validation, product readability tests, student responses to the product, product effectiveness in improving critical thinking skills, and increasing scientific literacy.

The purpose of the analysis of the Aiken V index is to determine the validity of each item in the assessment instrument. Calculation of the score for each statement item in the material and media test questionnaire can use analysis from Aiken V. The category rating for 5 raters (assessors) and 5 answer choices has a value of 0.8 with a probability of 5%, which is considered valid if the calculated V value ≥ V table. Aiken (1985) explains the

formula for calculating the validity coefficient of Aiken V as follows on Equation 1.

$$V = \frac{\sum r - l_o}{n\,(c-1)} \qquad (1)$$

The results of student pretest and posttest data were analyzed using normalized gain (N-gain) calculations to determine the effectiveness of ethnoscience-based electronic student worksheet in improving students' critical thinking and scientific literacy. Research data were analyzed using N-Gain (Abdurrahman et al., 2019; Allanta & Puspita, 2021; Astari & Sumarni, 2020; Kamal et al., 2024; Rosari, 2022). The increase in students' critical thinking competence and scientific literacy is measured by calculating the N-gain score using the following formula obtained from Hake (1999).

$$N - gain = \frac{\text{Posttest Score} - \text{Pretest Score}}{\text{Ideal Value} - \text{Pretest Score}} \qquad (2)$$

Table 1. Criteria for Interpreting N-Gain Values

N-Gain Value	Interpretation
g ≥ 0.70	High
0.30 < g < 0.70	Medium
g ≤ 0.30	Low

The results of calculating the N-gain score are interpreted using the classification according to (Hake, 1999), as shown in Table 1. Based on the N-Gain Value Interpretation Criteria in Table 1, it shows that if the N-gain value is ≥ 0.70, the effectiveness of the electronic student worksheet being developed is included in the high classification.

Result and Discussion

Result
Development of Ethnoscience-Based Student Worksheet

Analyze
The resulting development research is an ethnoscience-based student worksheet with the context of traditional Lampung food and drinks, which is integrated into science learning to train junior high school students' critical thinking and literacy skills. The first stage is designing ethnoscience-based student worksheet products with many of the necessary supporting instruments. The analysis stage includes collecting information about the learning environment through observation and interviews with teachers (Fatih et al., 2024).

A needs analysis was carried out at SMPN 1 Negara Batin, Way Kanan district, Lampung province. Based on the results of interviews and filling out questionnaires,

data was obtained that 100% of science teachers had never developed ethnoscience-based electronic worksheets. Class VIII students stated that 100% of students had never been given electronic worksheets at all, and had also never been given ethnoscience-based electronic worksheets related to local wisdom in the local area. All teachers and students strongly agree to develop ethnoscience-based electronic worksheets in the context of traditional Lampung food and drinks in science learning. Therefore, research into the development of ethnoscience-based electronic worksheets is very necessary.

Design
This design stage is an activity to design an ethnoscience-based student worksheet product design with many necessary supporting instruments. The design stage is a stage in designing learning media that includes formulating objectives, creating learning media according to student requests, making storyboards, which are the initial design of learning media, and designing to develop instruments to assess the validity and suitability of learning media (Fatih et al., 2024). According to Pratiwi & Rachmadiarti (2021) the design stage consists of writing the test criteria used, determining the media, determining the format, and the process of designing the product (cover, color, size, and layout). The design of this ethnoscience-based electronic student worksheet teaching material product highlights the local cultural wisdom of Lampung in the context of traditional Lampung food and drinks, namely the Lapis Legit, Engkak Ketan, Bebai Maghing, Seghubal, Kweni mango sherbet ice, and Durian luwak coffee.

This ethnoscience-based electronic student worksheet teaching material was designed using the Canva application, which was then inserted into the Liveworksheets digital platform application. The liveworksheet website application can facilitate easy access for teachers (teacher access) and students (student access) (Siagian et al., 2022). After designing the ethnoscience-based worksheet in the Canva application in PDF form, it was then uploaded to my worksheet in the Liveworksheets application. Then edit according to the features that will be used on the student's electronic worksheet to make it more interactive.

Develop
This ethnoscience-based electronic student worksheet product is designed into 5 activity sheet component parts, namely as follows: (1) The introductory section, which has 8 pages, consists of the cover of the ethnoscience-based electronic student worksheet, the researcher's identity, a foreword from the researcher, instructions for using the ethnoscience-based

electronic student worksheet, presentation of the contents (features) of the electronic student worksheet based on ethnoscience, overall learning content (general achievements, knowledge achievements, skill achievements, learning models, learning methods, ethnoscience content, ethnoscience context, and material), learning objectives, additive material, and videos on misuse problems related to dangerous additives; (2) The activity 1 student worksheet section has 10 pages consisting of activities based on 2 learning objectives such as let's give a simple explanation, let's pay attention, let's give further explanation, and let's identify; (3) The activity 2 student worksheet section has 7 pages consisting of activities based on 2 learning objectives such as let's investigate and let's collect data; (4) The activity 3 student worksheet section has 8 pages consisting of activities based on 2 learning objectives such as let's identify, let's collect data, and let's do; and (5) The activity 4 student worksheet section has 10 pages consisting of activities based on 2 learning objectives such as let's do activities, let's analyse, let's conclude, and let's reflect. The cover view of the ethnoscience-based electronic student worksheet is presented in Figure 3.

Figure 3. Cover of ethnoscience-based electronic student worksheet

Developing ethnoscience-based electronic student worksheet teaching materials refers to indicators of suitability for student worksheets according to BSNP (2012), there are 4 aspects that must be fulfilled, namely content suitability aspects, linguistic aspects, presentation aspects, and graphic aspects. Terms, symbols, sentences and language used in electronic student worksheets must be simple, clear and easy for students to understand. One display of the suitability of the ethnoscience-based electronic student worksheet contains the suitability of the content of learning achievement (CP) material as shown in Figure 4.

Figure 4. Contains Learning Achievements (CP) Material

Aspects of linguistic appropriateness have been presented in ethnoscience-based electronic student worksheet. The arrangement of sentence structures in the discourse on electronic student worksheet is correct so that they are easy to understand. Electronic student worksheets also use terms that are easy to understand, kind, polite, and pay attention to grammatical accuracy according to Enhanced Spelling (EYD) according to Indonesian language rules. This is in accordance with the opinion of Oktaviana *et al*. (2024) that the effectiveness of students' worksheet is influenced by the use of Indonesian according to correct rules and the presence of indirect, interactive communication with students, there by generating students' interest in learning. The linguistic aspects of electronic student worksheet are developed using sentences that are clear, easy to understand, effective, and communicative so that students can easily understand the concepts in the material being studied (Syahputri et al., 2023). The arrangement of language in electronic student worksheet must comply with PUEBI regulations and must be adjusted to the students' abilities (Siagian et al., 2022).

Aspects of appropriateness of presentation have been presented in ethnoscience-based electronic student worksheet. Ethnoscience-based student worksheet is

prepared by paying attention to presentation aspects which include pictures, videos and practice questions according to students' learning styles (Hendriani & Gusteti, 2021). This attractive appearance can make it easier for students to understand reading and analyse the problems presented (Ningrum et al., 2024). Ethnoscience-based student worksheet can be found in the first stage, namely understanding a problem (Suparwati et al., 2023). The presentation on electronic student worksheet presented first is a video showing real-life problems regarding the misuse of dangerous additives in food. One display that reflect the aspect of presenting material is in Figure 5.

Figur 5. Suitability of material presentation

Aspects of graphic feasibility have been presented in ethnoscience-based electronic student worksheet. The color composition used in ethnoscience-based electronic student worksheet is contrasting so that the writing is clearly visible. The typography of the letters used facilitates understanding and increases interest in electronic student worksheet. The features contained in electronic student worksheet must be well designed to help students better digest learning material in the context of science in everyday life (Ariq & Fitrihidajati, 2021).

The media development process involves the product creation stage, where all components such as content, ratings, images, videos, and music are collected for use (Fatih et al., 2024). Ethnoscience-based student worksheet products that have been designed using Canva and uploaded on the Liveworksheets website can now be validated by expert experts on a limited scale.

This is in line with research from Burgawanti et al. (2023) who also validated the product being developed to measure its suitability before testing it on students. At the stage of developing ethnoscience-based electronic student worksheet, validation tests were carried out by material experts and media experts, and trials were carried out on a small or limited scale with students.

Feasibility and validity of ethnoscience-based student worksheet

The feasibility of this ethnoscience-based electronic student worksheet product was validated by experts in materials and media (Rosari, 2022). In the ethnoscience-based electronic student worksheet validation test, five material experts and five media experts were involved to validate the product that h ad been developed. Material expert and media expert validators were given a questionnaire assessment instrument in the form of a rating scale using a Likert scale with 20 statement items. Expert validation instruments are used to obtain data in the form of product quality in terms of media and material aspects (Farzana et al., 2024). Analysis of the feasibility of science teaching materials in an ethnoscience context based on validation results carried out by expert judgment (Risamasu et al., 2023). There were five validators involved for the material expert test and media expert test, namely three chemistry lecturers and two science teachers. An analysis of the Aiken V value for five assessors with a maximum answer scale of 5 can be referred to from the Aiken V table, which is at a value of 0.8. Therefore, the minimum V value accepted with an error rate of 5% is 0.8. The decision category is based on the Aiken V scale table with five assessors (validators), namely if the V value ≥ 0.8 is declared valid and if the V value ≤ 0.8 is declared invalid. The feasibility of an ethnoscience-based electronic student worksheet as assessed by media experts and material experts is presented in Table 2.

Table 2. Product Feasibility Test Results

Expert Validator	Validity Value	Category
Material	0.98	Valid
Media	0.97	Valid

Based on the assessment results from five validators in the material test and media test of the ethnoscience-based electronic student worksheet product, its feasibility was declared with a high level of validity in all aspects of each statement item. However, there are still a few suggestions and inputs from experts regarding the electronic student worksheet being developed. For media, there are no changes in color or graphics, only in general regarding punctuation, use of typeface, and letter thickness.

This limited ethnoscience-based electronic student worksheet trial was carried out on class IX students. Ethnoscience-based electronic worksheets that are ready to be tested by copying the electronic worksheet link that has been uploaded to Myworksheet and then distributed to students to share with student groups via the WhatsApp group. This electronic student worksheet can be accessed from computers, laptops, and smartphones. Students who have tested the use of ethnoscience-based electronic student worksheet are then given a questionnaire on the readability of the material and the readability of the media. At the small-scale trial stage, readability testing by students is very necessary, because it is the students who use electronic student worksheet directly. The results of the student readability questionnaire are in Table 3.

Table 3. Readability Test Results by Students

Aspect	Average Value	Criteria
Material	99.00	Very nice
Media	98.81	Very nice

At the product development stage, apart from validating and testing electronic LKS products, question instruments were also validated to measure students' critical thinking abilities and scientific literacy. Multiple choice questions and essay questions that are valid and reliable are used to measure the level of students' critical thinking abilities and scientific literacy at the implementation stage to determine the effectiveness of ethnoscience-based electronic worksheet products.

Implementation

The implementation of ethnoscience-based electronic student worksheet was given to the experimental group, namely class VIII B students at UPT SMPN 1 Negara Batin to determine the improvement of students' critical thinking skills and science literacy. the improvement of students' abilities is measured by pretest and posttest using test questions. the types of questions used are multiple choice with critical thinking skills indicators and essay questions with science literacy indicators.

The Effectiveness of Electronic Student Worksheet for Improving Critical Thinking Skills and Scientific Literacy

The implementation stage was carried out by applying ethnoscience-based electronic electronic student worksheet teaching materials in the experimental class, which had been validated by experts and tested for readability by students. In organizing the class with a blended ethnoscience learning strategy, the teacher presents lessons by connecting concepts with cultural and traditional practices in the students' environment (Uppu and Okrawala, 2024). According to

Sari (2024) processing sources of teaching materials in order to instill a love of local culture will make learning activities more effective and lead to achieving learning goals. It is at this research implementation stage that the effectiveness of student worksheet can be measured. Critical thinking and scientific literacy questions were given during the pre-experiment (pretest) and post-experiment (posttest) using ethnoscience-based electronic student worksheet products.

The effectiveness of electronic student worksheet teaching materials on students' critical thinking competencies was analyzed using the N-Gain Score test based on the difference in pretest and posttest scores. After implementing the learning treatment using ethnoscience-based electronic student worksheet, there was an increase in students' critical thinking competence and scientific literacy from the increase in posttest results. The students' low pretest scores were due to their not being used to working on critical thinking and scientific literacy questions. This was stated by Siagian et al. (2022) which states that the reason for the low score of students completion on the pretest is because students do not have sufficient initial knowledge so there are still conceptual errors in the material. The results of the N-gain score test for critical thinking competency and scientific literacy are presented in Table 4 and Table 5.

Table 4. Results of N-Gain Critical Thinking Competency

Pretest Value	Posttest Value	Difference	N-Gain Score	Critical
36.96	91.07	54.11	0.856	Tall

Table 5. N-Gain Results for Science Literacy Competency

Pretest Value	Posttest Value	Difference	N-Gain Score	Critical
37.94	91.73	53.80	0.865	Tall

Based on the results in Table 5 and Table 6, it shows that there is an increase in critical thinking competence and scientific literacy with the N-Gain score test. This is proven by the results of the analysis of students' answers, which showed an increase in pretest and posttest scores. Results of the analysis of increasing critical thinking indicators are shown in Figure 6.

The average percentage value of each critical thinking indicator increased significantly after the ethnoscience-based electronic student worksheet was implemented. This is because the questions presented in ethnoscience-based electronic student worksheet can train critical thinking competencies. The results of the improvement analysis for scientific literacy indicators are presented in Figure 7.

Based on Figure 7, the diagram shows that the average percentage value of each scientific literacy indicator has increased significantly after the implementation of the ethnoscience-based electronic student worksheet. This is because the questions presented in ethnoscience-based electronic student worksheet can train scientific literacy competencies. Based on research data analysis, it is known that in general, there is an increase in students' critical thinking abilities and students' scientific literacy after the learning process uses student worksheet containing ethnoscience.
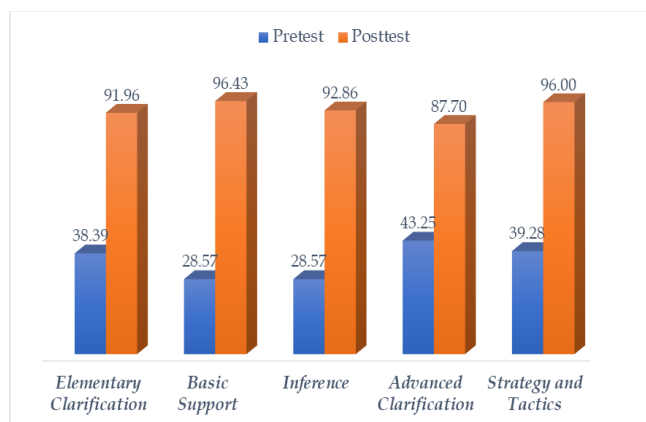

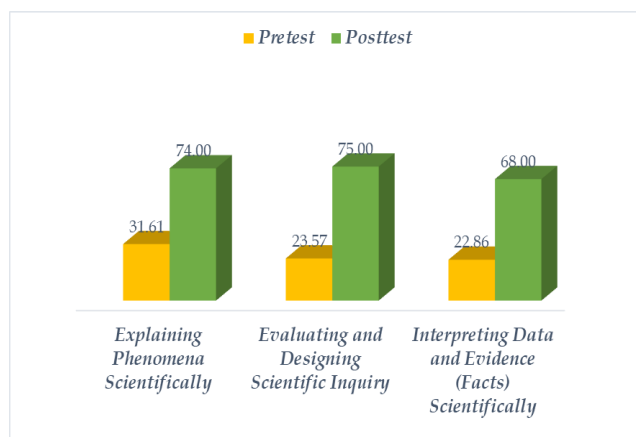**Figure 6.** Increasing the Value of Critical Thinking Indicators

Figure 7. Increase in Scientific Literacy Indicator Values

At the end of the research, after students carried out a series of science learning activities using ethnoscience-based electronic student worksheet, they were given a student response questionnaire. This student response is to assess the effectiveness of ethnoscience-based electronic student worksheet in general after conducting research. Student responses are also part of the effectiveness of the electronic student worksheet developed (Zahroh & Yuliani, 2021). Student response data obtained from filling out the questionnaire was analyzed by determining the number of numbers that gave positive and negative responses to the question

categories in the questionnaire (Buyung et al., 2020). Students are asked to fill out a statement respondent questionnaire to provide feedback on their learning experience using the product being developed (Fatih et al., 2024). Results The average value of student responses according to aspects is presented in Table 6.

Table 6. Results of Student Responses

Questionnaire Aspect	Average value (%)	Criteria
Content criteria	100	Very Good
Language	99.2	Very Good
Presentation	98.3	Very Good
Graphics	100	Very Good
Average Value	99.35	Very Good

Based on Table 6, the results of student responses get an average score of 99.35%, so it can be said that this electronic student worksheet is very effective to use. Below is a diagram of student responses to the ethnoscience-based electronic student worksheet which can be seen in Figure 8.
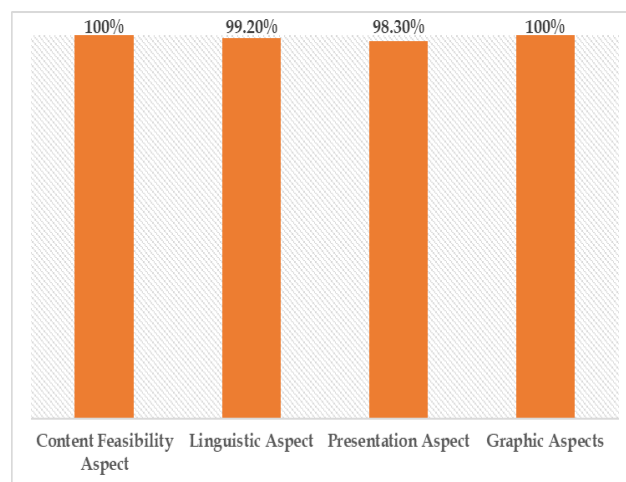

Figure 8. Student Response Diagram on Product Feasibility

Evaluation

Evaluation is the final stage of the development process. This evaluation stage was conducted to assess and refine each phase of research and development to create ethnoscience-based electronic electronic student worksheet teaching materials for science education. Continuous evaluation is conducted at every stage, incorporating enhancements and revisions based on assessments, feedback, and suggestions from expert evaluators, as well as student reactions to ethnoscience-based electronic student worksheet. This process aims to pinpoint shortcomings at each research stage to facilitate additional enhancements for the creation of superior ethnoscience-based electronic student worksheet products.

Discussion

In recent years, learning using an ethnoscience approach has increasingly developed and has been integrated into science learning in the form of student worksheet teaching materials. Ethnoscience-based student worksheet developed by several previous researchers has been proven to increase students' interest in learning, cognitive learning outcomes, critical thinking, and scientific literacy (Agatha & Budiyanto, 2021; Nabil *et al.*, 2022; Ariningtyas *et al.*, 2017; Astari & Sumarni, 2020; Junita & Yuliani, 2022; Lestari & Muchlis, 2021; Sya'diyah *et al.*, 2023). Ethnoscience-based electronic student worksheet designed to raise problems that are closely related to life can increase students' learning motivation (Siagian et al., 2022). Electronic student worksheet based on scientific literacy is effective in training students' critical thinking skills (Zahroh & Yuliani, 2021).

Based on the results of research and development of ethnoscience-based electronic student worksheet products equipped with instructions for use, achievement of learning outcomes, learning objectives, images, learning videos, observation tables, critical thinking questions, scientific literacy questions, evaluation questions, and additive material with an ethnoscience context of traditional Lampung food and drinks which can foster student enthusiasm and interest in the science learning process. This is due to the experience of the latest learning process using ethnoscience-based electronic student worksheet teaching materials which highlight traditional Lampung food and drinks such as traditional cake (Lapis Legit, Engkak Ketan, Bebai Maghing, Seghubal), Mango Kweni sherbet ice, and Durian luwak coffee. In line with research from Andani et al. (2020) who has developed ethnoscience-based student worksheet to provide ethnoscience information about several local wisdoms that exist around the Acehnese community, such as serabi cakes that use durian leaf extract as a natural improver.

Electronic student worksheet equipped with pictures, learning videos, quizzes, evaluations and structured material that can foster student interest in carrying out the learning process in class (Saputra et al., 2024). The development of ethnoscience-based Electronic Student Worksheet teaching materials was produced using the Canva and Liveworksheets applications which include more interactive material, videos and practice questions. The development of information technology in the world of education is increasingly developing, one of which is the presence of interactive multimedia applications such as Canva, Liveworksheets and other applications. Interactive multimedia is part of the media as tools and materials that have a combination of words, images, animation and video (Cholid & Peni, 2024). The features contained in electronic student worksheet must be well-designed to help students better digest learning material in the context of science in everyday life (Ariq & Fitrihidajati, 2021). The use of varied media in electronic student worksheet can increase students' curiosity and avoid boredom during learning (Farida et al., 2024).

This electronic student worksheet teaching material was designed using Canva and the final product was uploaded to the Liveworksheets website application to make it more interactive. The Liveworksheets application is an electronic media that contains text, images, animations and videos which are effective in helping students feel bored when working on questions (Nurafriani & Mulyawati, 2023; Fitriyeni, 2023). Liveworksheet can convert traditional printable worksheets in formats (Document, PDF, and JPG) into interactive online exercises with accompanying video, images, and audio (Farida et al., 2024). This Liveworksheet is an application that can be used to create interactive student materials and worksheets online which allows students to access electronic student worksheets anywhere and also contains audio-visual explanations (Nurafriani & Mulyawati, 2023). Liveworksheet is a medium that turns ordinary worksheet into interactive, interesting ones and of course presented online.

At the trial stage, there were several obstacles when accessing the electronic student worksheet teaching materials: there were students who were not allowed to bring mobile phones (smartphones), there were students who did not have an active email to register, there were students who did not have an internet data, an internet network that was less stable, and there were students who were less agile in using smartphones or notebooks (laptops). According to Oktaviana et al. (2024) some of the obstacles students face when working on electronic student worksheet include poor internet connectivity and graphic choices that don't seem to suit students' needs. Based on this small-scale trial, several obstacles have become benchmarks for improvement and anticipation when implementing ethnoscience-based electronic student worksheet and actual research will be carried out.

There are also many advantages that can be obtained when using electronic student worksheet on the Liveworksheets website platform, namely (1) electronic student worksheet become more interactive because they are presented with embedded videos from YouTube, material from websites, and from other applications, (2) worksheet electronic students are more efficient to use because they can be used anytime, anywhere online without requiring excessive costs, (3)

electronic student worksheet are more effective to use because they are done quickly and the value can be seen or appears. This is the same as what was expressed by Zikri & Handayani (2024) that research into the development of electronic student worksheet needs to always be pursued to foster effective and efficient learning. In line with research results fromSuparwati et al. (2023) revealed that one of the benefits of using electronic student worksheet with Liveworksheets is that the scores of students' work automatically appear on the student worksheet after completing the assessment questions. Also supported by research Burgawanti et al. (2023) that student worksheet that are prepared well, creatively and innovatively using the Liveworksheets application can be one solution in developing student worksheet that are more interesting and varied and can foster a pleasant learning atmosphere. Another advantage of using electronic student worksheet is that learning is more practical and flexible, saves time, is easy to access and can be done anywhere(Amalia, et al., 2022). Electronic student worksheet created using Liveworksheets have many benefits. Another benefit of using Liveworksheets electronic student worksheet is that they save space and time; makes it look unattractive, environmentally friendly because it is digitally available, always available, has a compact design and large capacity, and is definitely efficient in reducing costs (Oktavianto & Aghni, 2022). Electronic Student worksheet from Liveworksheets are more effective and efficient for use in education to make it easier for students and reduce the use of paper or books, pens, and make it easier for teachers to give assignments, without printing paper or copying (Farida et al., 2024).

The feasibility of an ethnoscience-based electronic student worksheet was analyzed based on the validation results of material experts, media experts, and readability questionnaire responses from students (Astari & Sumarni, 2020). The feasibility of an ethnoscience-based electronic student worksheet was analyzed based on the validation results of material experts, media experts, and a readability questionnaire of responses from students (Astari & Sumarni, 2020). The ethnoscience-based electronic student worksheet teaching materials were developed and tested by material experts and media experts, and the results were declared valid. The material expert and media expert testing stage is crucial to determining the feasibility and validity of the electronic student worksheet product before it is used in the trial and research stages. Based on the results of expert validation and readability tests by students, the ethnoscience-based electronic student worksheet are considered to have met a high level of feasibility. The feasibility of this ethnoscience-based

electronic student worksheet was developed based on the feasibility indicators for student worksheet from BSNP (2012) which include 4 aspects that must be met, namely appropriateness of content, language, presentation and graphics. At the validation stage, the feasibility of electronic student worksheet utilizes a modified validation sheet instrument from the National Education Standards Agency (BNSP) which has 4 important aspects of validation components including suitability of content, presentation, language and graphics (Iskandar & Balad, 2023; Rizkika et al., 2022; Septonanto et al., 2024; Zikri & Handayani, 2024).

The appropriateness of the content of the material that has been presented in the ethnoscience-based electronic student worksheet contains material that is in accordance with learning outcomes (CP) and learning objectives (TP). Based on the opinion of Anggrayni et al. (2024) a good electronic student worksheet is equipped with instructions for use, has clear learning outcomes and learning objectives according to the level and material presented. Ethnoscience-based electronic student worksheet contain indicators of content suitability with valid criteria where the science material contained in electronic student worksheet is presented in the form of systematic discourse and contains ethnoscience elements according to the level of detail. The discourse on ethnoscience-based electronic student worksheet as a whole consists of factual events, data displayed accurately, and science concepts in additive material conveyed correctly through an ethnoscience approach. contains science concepts in additive material conveyed correctly through an ethnoscience approach. According to Walida et al. (2023) ethnoscience-based electronic student worksheet are suitable for increasing students' understanding of science concepts. This visually appealing format can facilitate students' comprehension of the text and their ability to analyze the problems presented (Ningrum et al., 2024).

The effectiveness of ethnoscience-based electronic student worksheet can generally be determined through analysis of the results of response questionnaires regarding aspects of appropriateness of material content, language, presentation appearance, and graphics. After working on the electronic student worksheet, students fill out a student response questionnaire to find out student responses to the electronic student worksheet they have used (Umaroh et al., 2022). Providing written response questionnaires can determine students' responses regarding whether they are happy or not with certain aspects of learning, as stated on electronic student worksheet (Andriani et al., 2018). Utilizing the use of electronic student worksheet can help reduce the teacher's workload but can increase the role of students (Amalia et al., 2022).

Ethnoscience-based electronic student worksheet are designed while still paying attention to presentation aspects which include pictures, videos and practice questions according to students' learning styles. This attractive appearance can make it easier for students to understand the reading and analyze the problems presented. This is in accordance with opinion of Kiswanto et al., (2024) that students' critical thinking competence can be improved by problem-based learning in the real world, analyzing events, being able to interpret events, and creating alternative solutions that suit needs. Ethnoscience-based electronic student worksheets are presented systematically and contain questions to practice critical thinking skills. PBL-based electronic student worksheets valid, practical and effective can train students' critical thinking skills (Sani & Ambarwati, 2024). According to Siagian et al. (2022) the use of electronic student worksheet helps students focus on problem solving, easily adapting to social, cultural and technological life. Based on research from Sya'diyah et al. (2023), problem-based integrated science student worksheet can develop interpersonal intelligence through inter-group collaboration and student self-evaluation of class activities to achieve learning success. Proficiency in solving the presented problems enables students to utilize their critical thinking skills to structure and articulate arguments based on the information they have gathered with their peers (Wahyuningtyas et al., 2023).

Indicators of critical thinking skills used in these questions refer to Ennis (1985), including providing simple explanations, building basic skills, concluding, providing further explanations, as well as strategies and tactics (Salsabilla et al., 2024b). Critical thinking is reasonable and reflective thinking that focuses on deciding what to believe or do (Ennis, 2011). The effectiveness of ethnoscience-based electronic student worksheet teaching materials is measured based on learning outcomes of critical thinking skills with pretests and posttests which are structured based on critical thinking indicators. Critical thinking skills can be measured by multiple choice tests, description tests, reasoned multiple choice tests, or skills tests (Agustiana, 2019). This is in line with research from Maruti & Widuri (2023) which states that almost all critical thinking indicators in research can be met by students with high critical thinking competence. Research on the development of ethnoscience-based electronic student worksheet teaching materials can improve overall indicators of students' critical thinking. This is in line with the results of research from Salsabilla et al. (2024) that the electronic student worksheet that were developed were able to improve critical thinking skills, seen from the average increase in students' overall

critical thinking skills scores for each indicator which experienced a significant increase and each indicator also experienced a different increase in critical thinking skills. Based on the results of observations of several research journals that have been analyzed by Purnamasari et al. (2021) the application of an ethnoscience approach can improve students' critical thinking skills in group discussion activities, link scientific learning with community culture, and re-synthesize information about knowledge. Based on the results of the research, it shows that the application of the Ethno Science-based Chemistry Learning model can improve cognitive and critical thinking skills (Risdianto et al., 2020).

Scientific literacy is the ability to understand scientific concepts and processes and use science to solve everyday problems (Mahyuny et al., 2022). The scientific literacy skill indicators used in these questions use references from the OECD (2016). The scientific literacy skills measured in this research include the ability to explain scientific phenomena, evaluate and design scientific investigations, and facilitate scientific data and evidence (Wildayanto & N, 2020). The learning objective of integrating scientific literacy into student worksheet is to help students successfully solve scientific phenomena they encounter in their lives (Iskandar & Balad, 2023). Ethnoscience-based electronic student worksheet can be used to increase students' scientific literacy. This is proven by opinion of Muhlis et al. (2023) that Student Worksheets are a medium or teaching material that can help train scientific literacy skills. Ethnoscience-based electronic student worksheet learning media can create a learning atmosphere that is not monotonous, because students can learn directly from the regional cultural wisdom that exists in their respective regional environments. According to research Januarti & Muliyadi (2024) the use of electronic student worksheet based on scientific literacy in learning has a positive effect on students' scientific literacy. Based on research from Pertiwi et al. (2021) that the use of student worksheet tools containing ethnoscience material on salt hydrolysis can successfully increase students' scientific literacy. Research into the development of ethnoscience worksheet products based on scientific literacy received feasibility scores of very valid, very practical, and very effective based on the results of assessments from validators and student responses (Mahyuny et al., 2022).

The electronic student worksheet developed in this research contains indicators of scientific literacy, one of which is training students to be able to explain phenomena scientifically (Ariningtyas et al., 2017). These indicators are presented in problem-based learning activities in the form of videos and images related to additives found in traditional foods. Through

these learning activities, students identify an event from the problem (Jufrida et al., 2019). The results of this research prove that ethnoscience-based electronic student worksheet with problem-based learning methods can improve students' critical thinking skills and scientific literacy abilities. This is in line with research by Cholid & Peni (2024) regarding the development of electronic student worksheet based on problem-based learning using live worksheet to enhance students' critical thinking skills. Wahyuningtyas et al. (2023) suggest that increasing critical thinking can be improved with ethnoscience-based learning. Niswah & Asih (2023) found that the use of problem-based learning models can enhance students' critical thinking skills. Additionally, the research aligns with the study conducted by Januarti & Muliyadi (2024), which indicates that learning with ethnoscience-based electronic student worksheet can boost students' scientific literacy. Student worksheets that have been validated by material experts, media experts and practice experts to carry out scientific literacy-based ethnoscience learning (Mahyuny et al., 2022).

There is positive and significant relationship between scientific literacy abilities and skills critical thinking, scientific literacy positively and significantly related to students' critical thinking based on regression testing simple linear (Parinduri et al., 2023). The relationship between critical thinking and scientific literacy can help students improve their ability to give meaning, interpret, translate, and express concepts influenced by scientific literacy and critical thinking (Bahri et al., 2021). Scientific literacy emphasizes the importance of thinking and involves mastering thinking by overcoming several problems that develop in society. Scientific literacy can develop along with the development of reasoning and thinking abilities in social life (Sutrisna, 2021). According to Ridzal (2022) understanding science thoroughly requires good thinking skills. The lower the student's scientific literacy, the lower the student's critical thinking ability, and the higher the scientific literacy, the higher the student's critical thinking ability (Juhji & Mansur, 2020).

Scientific literacy equips students with the acquisition of scientific concepts and assists in solving everyday problems encountered in the surrounding environment (Primasari et al., 2020). Scientific literacy is one of the factors that play a role in developing students' critical thinking abilities. Critical thinking skills are important, fundamental intellectual assets, and play a major role in science education (Ridzal & Haswan, 2023). This is in line with the research results of Odah and (Odah & Yuniarti, 2023) that students who have good scientific literacy will have high-level thinking abilities because, in scientific literacy, students are

required to implement the knowledge they have in everyday life.

Based on research results and several references, it can be concluded that ethnoscience-based electronic student worksheet have a high level of effectiveness in improving junior high school students' critical thinking skills and scientific literacy. Results can be seen through the increase in pretest to posttest scores which are analyzed using the N-Gain score in the high category. Effectiveness is generally seen based on student responses to student worksheet that have high scores in the very good category.

Conclusion

Based on the results of development research and data analysis, it can be concluded that ethnoscience-based electronic student worksheet assisted by the liveworksheet application on additive material for grade VIII students in science learning get very good feasibility criteria on the results of validation tests from material experts and media experts and readability tests from students. Ethnoscience-based electronic student worksheets obtained validity results from material experts with an average score of 4.8 and a validity of 0.98, as well as from media experts with an average score of 4.9 and a validity of 0.97. Ethnoscience-based electronic worksheet products are effective in improving students' critical thinking skills, based on the N-Gain Score of 0.86 which has high criteria. Ethnoscience-based electronic LKS teaching material development products are also effective in improving students' scientific literacy skills, based on the N-Gain Score of 0.87 which is included in the high criteria. Based on the research results, it shows that ethnoscience-based electronic worksheets with the context of traditional Lampung food and drinks using additive material are very feasible and valid for use. In fact, this ethnoscience-based electronic worksheet is very effective in improving junior high school students' critical thinking and scientific literacy skills.

Author Contributions
This article was prepared by three people, namely EKK, AW, WS and TDW. All members help each other cooperatively in carrying out each stage until the article is finished. The author has read, evaluated, and approved the published manuscript of this article.

References

Abdurrahman, A., Setyaningsih, C. A., & Jalmo, T. (2019). Implementating multiple representation-based worksheet to develop critical thinking skills. *Journal of Turkish Science Education*, *16*(1), 138–155. https://doi.org/10.12973/tused.10271a

Agatha, V., & Budiyanto, M. (2021). Kevalidan Lembar Kerja Peserta Didik Berbasis Etnosains Pada Materi Pemisahan Campuran untuk Meningkatkan Hasil Belajar Siswa. Pensa E-Jurnal : Pendidikan Sains, *9*(1), 35-40. Retrieved from https://ejournal.unesa.ac.id/index.php/pensa/article/view/38489

Agustiana, J. (2019). Analisis kemampuan berpikir kritis siswa pada materi koloid. *SPEKTRA : Jurnal Kajian Pendidikan Sains*, *5*(1), 91. https://doi.org/10.32699/spektra.v5i1.80

Allanta, T. R., & Puspita, L. (2021). Analisis keterampilan berpikir kritis dan self efficacy peserta didik: Dampak PjBL-STEM pada materi ekosistem. *Jurnal Inovasi Pendidikan IPA*, *7*(2), 158–170. https://doi.org/10.21831/jipi.v7i2.42441

Amalia, D., Zaini, M., & Halang, B. (2022). Kualitas E-LKPD (Elektronik Lembar Kerja Peserta Didik) Konsep Plantae Berbasis Keterampilan Berpikir Kritis Jenjang SMA. *Journal of Mathematics Science and Computer Education*, *2*(1), 1. https://doi.org/10.20527/jmscedu.v2i1.4768

Amalia, I., Roesminingsih, M. V., & Yani, M. T. (2022). Pengembangan LKPD Interaktif Berbasis Liveworksheet untuk Meningkatankan Hasil Belajar IPS Sekolah Dasar. *Jurnal Basicedu*, *6*(5), 8153–8162. https://doi.org/10.31004/basicedu.v6i5.3762

Andani, D. T., Gani, A., Pada, A. U. T., & Rahmatan, H. (2020). Ethnoscience-Based Student Worksheet Development to Improve Senior High School Student Creativity. *Jurnal Penelitian Pendidikan IPA*, *7*(1), 26. https://doi.org/10.29303/jppipa.v7i1.457

Andriani, N., Saparini, S., & Akhsan, H. (2018). Kemampuan Literasi Sains Fisika Siswa SMP Kelas VII Di Sumatera Selatan Menggunakan Kerangka PISA (Program for International Student Assesment). *Berkala Ilmiah Pendidikan Fisika*, *6*(3), 278. https://doi.org/10.20527/bipf.v6i3.5288

Anggrayni, M., Darniyanti, Y., Amal, I., & Indonesia, U. D. (2024). Pengembangan Elektronik Lembar Kerja Peserta Didik (E-LKPD) Mata Pelajaran IPAS Di Kelas IV SDN 07 Sitiung. *INNOVATIVE: Journal Of Social Science Research*, *4(3), 17302-17324*. retrieved from https://j-innovative.org/index.php/Innovative

Ariningtyas, A., Wardani, S., & Mahatmanti, W. (2017). Efektivitas Lembar Kerja Siswa Bermuatan Etnosains Materi Hidrolisis Garam untuk Meningkatkan Literasi Sains Siswa SMA. *Journal of Innovative Science Education*, *6*(2), 186–196. https://journal.unnes.ac.id/sju/index.php/jise

Ariq, F. (2021). Validitas E-LKPD "Ekosistem" Berbasis Saintifik Untuk Melatih Keterampilan Berpikir Kritis Siswa Kelas X SMA. *Berkala Ilmiah Pendidikan Biologi (BioEdu)*. *10*(3), 562–571. https://doi.org/10.26740/bioedu.v10n3.p562-571

Astari, J. I. R., & Sumarni, W. (2020). Pengembangan Lembar Kerja Peserta Didik Bermuatan Etnosains Guna meningkatkan Kemampuan Berpikir Kritis. *Journal of Chemistry in Education*, *9*(2), 1–9. Retrieved from https://journal.unnes.ac.id/sju/index.php/chemined/article/view/39582

Ayuni, Q., & Tressyalina. (2020). Analysis of Needs Of E-LKPD Based on Contextual Teaching and Learning (CTL) in Linear Learning for Exposition Text Materials. *485(Iclle),* 279–283. https://doi.org/10.2991/assehr.k.201109.047

Bahri, A., Jamaluddin, A. B., Muharni, A., Fikri, M. J. N., & Arifuddin, M. (2021). The Need of Science Learning to Empower High Order Thinking Skills in 21st Century. *Journal of Physics: Conference Series*, *1899*(1). https://doi.org/10.1088/1742-6596/1899/1/012144

Bayley, S. H. (2022). Learning for adaptation and 21st-century skills: Evidence of pupils' flexibility in Rwandan primary schools. *International Journal of Educational Development*, *93*(March), 102642. https://doi.org/10.1016/j.ijedudev.2022.102642

Burgawanti, Kartono, Ghasya, D. A. V., Kresnadi, H., & Suparjan. (2023). Kelayakan Lembar Kerja Peserta Didik Berbasis Liveworksheet Pada Pembelajaran Tema 3 Subtema 2 Kelas IV SD Negeri 01 Jagoi Babang. *Jurnal on Education*, *5*(4), 11558–11565. http://jonedu.org/index.php/joe

Buyung, B., Sumarli, S., & Rosmaiyadi, R. (2020). Development of problem based learning based on ethnomatematics to support students' mathematics literacy ability and self-confidence. *AIP Conference Proceedings*, *2268*. https://doi.org/10.1063/5.0017833

Chiruguru, S. B. (2020). The Essential Skills of 21 st Century Classroom. *Shingania University*, *10*(1), 1–13. https://doi.org/10.13140/RG.2.2.36190.59201

Chofifah, N., & Wintarti, A. (2023). Development of Student Worksheets Electronic (E-LKPD) for Geometry Transformation Materials. *MATHEdunesa*, *12*(1), 92–107. https://doi.org/10.26740/mathedunesa.v12n1.p92-107

Cholid, F., & Peni, N. R. N. (2024). Pengembangan E-LKPD berbasis PBL menggunakan liveworksheet untuk meningkatkan kemampuan berpikir kritis pada materi ukuran pemusatan data. *Jkpm*, *9*(2), 219–228. Retrieved from http://journal.lppmunindra.ac.id/index.php/jkpm/

Dewi, C. A., Erna, M., Martini, Haris, I., & Kundera, I. N. (2021). Effect of Contextual Collaborative Learning Based Ethnoscience to Increase Student's Scientific Literacy Ability. *Journal of Turkish Science Education*, *18*(3), 525–541. https://doi.org/10.36681/tused.2021.88

Dragos, V. M., & Mih, Viorel. (2015). Scientific Literacy in School. *Procedia - Social and Behavioral Sciences, 209*, 167–172. https://doi.org/10.1016/j.sbspro.2015.11.273

Ennis, R. H. (2011). *Sifat Berpikir Kritis : Garis Besar Disposisi dan Kemampuan Berpikir Kritis*. University of Illinois. 1–8. Retrieved from https://r.search.yahoo.com/_ylt=AwrKBZw0jd5 mussZIN3.ZHRG;_ylu=Y29sbwNzZzMEcG9zAzI EdnRpZAMEc2VjA3Ny/RV=2/RE=1725889972/ RO=10/RU=https%3a%2f%2feducation.illinois.ed u%2fdocs%2fdefault-source%2ffaculty-documents%2frobert-ennis%2fthenatureofcriticalthinking_51711_000.p df/RK=2/RS=F_4Dy6fscbiE8AmM6004RapJOpw-

Falah, C. M. N., Windyariani, S., & Suhendar. (2018). Peningkatan Kemampuan Berpikir Kritis Peserta Didik Melalui Model Pembelajaran Search, Solve, Create, And Share (SSCS) Berbasis Etnosains Improvement Of Students' Critical Thinking Skill Through Search, Solve, Create, And Share (SSCS) Learning Model Based. *Jurnal Penelitian Pendidikan Biologi*, *2*(1), 25–32. Retrieved from http://jurnal.um-palembang.ac.id/index.php/dikbio

Farida, G., Engol, S., Tindangen, M., & Yulliono, Y. (2024). Respon Peserta Didik terhadap Penggunaan E-LKPD Liveworksheets pada Materi Transformasi Geometri. *Jurnal Inovasi Refleksi Profesi Guru*, *1*(1), 8–14. https://doi.org/10.30872/jirpg.v1i1.3320

Farzana, N. A. L., Miranti, M. G., & Purwidiani, N. (2024). Pengembangan E-LKPD Berbasis Liveworksheet pada Kompetensi Menganalisis Ruang Lingkup, Giliran dan Karakteristik Menu

Kontinental. Journal of Vocational and Technical Education (JVTE), 6(1), 28–36. https://doi.org/10.26740/jvte.v6n1.p28-36

Fatih, M., Alfi, C., & Muqtafa, M. A. (2024). Science Learning Game (SLG) Based on Augmented Reality Enhances Science Literacy and Critical Thinking Students Skills. *Jurnal Penelitian Pendidikan IPA*, *10*(2), 973–981. https://doi.org/10.29303/jppipa.v10i2.6107

Fitriyeni, F. (2023). Pengembangan LKPD Digital Berbasis Etnosains Melayu Riau pada Muatan IPA Sekolah Dasar. *Jurnal Basicedu*, *7*(1), 441–451. https://doi.org/10.31004/basicedu.v7i1.4399

Hadi, W. P., Sari, F. P., Sugiarto, A., Mawaddah, W., & Arifin, S. (2019). Terasi Madura: Kajian Etnosains Dalam Pembelajaran Ipa Untuk Menumbuhkan Nilai Kearifan Lokal Dan Karakter Siswa. *Quantum: Jurnal Inovasi Pendidikan Sains*, *10*(1), 45. https://doi.org/10.20527/quantum.v10i1.5877

Hake, R. R. (1999). Analyzing change/gain scores. *Unpublished.[Online] URL: Http://Www. Physics. Indiana. Edu/\~ Sdi/AnalyzingChange-Gain. Pdf*, *16*(7), 1073–1080. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/2202588 3%5Cnhttp://scholar.google.com/scholar?hl=en &btnG=Search&q=intitle:ANALYZING+CHANG E/GAIN+SCORES#0%5Cnhttp://scholar.google. com/scholar?hl=en&btnG=Search&q=intitle:Anal yzing+change/gain+scores#0

Hendriani, M., & Gusteti, M. U. (2021). Validitas LKPD Elektronik Berbasis Masalah Terintegrasi Nilai Karakter Percaya Diri untuk Keterampilan Pemecahan Masalah Matematika SD Di Era Digital. *Jurnal Basicedu*, *5*(4), 2430–2439. Retrieved from https://jbasic.org/index.php/basicedu/article/v iew/1243

Hikmawati, H., Suastra, I. W., & Pujani, N. M. (2020). Ethnoscience-Based Science Learning Model to Develop Critical Thinking Ability and Local Cultural Concern for Junior High School Students in Lombok. *Jurnal Penelitian Pendidikan IPA*, *7*(1), 60. https://doi.org/10.29303/jppipa.v7i1.530

Iskandar, A. M., & Balad, A. Al. (2023). Validity of Student Worksheet Integrated Scientific Literacy for the Use of Physics Practicum Integrated Instrument Components in Temperature and Heat. JIPI (Jurnal IPA dan Pembelajaran IPA), 7(4), 302–316. Http//doi.org/10.24815/jipi.v7i4.33317

Januarti, I. M., & Muliyadi, L. (2024). Development of Ethnoscience-Based Student Worksheet Using the Guided Inquiry Learning Model to Increase Students' Learning Motivation and Scientific Literacy: A Review. *International Journal of Science*

Education and Science, *1*(1), 13–18. https://doi.org/10.56566/ijses.v1i1.109

Jufrida, J., Basuki, F. R., Sawitri, E., & Afriani, E. (2019). Need Analysis of Science Textbook Based Jambi Local Wisdom to Improve Science Literacy of SMPN 7 Muaro Jambi. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *9*(2), 151–160. https://doi.org/10.30998/formatif.v9i2.3340

Juhji, J., & Mansur, M. (2020). Pengaruh Literasi Sains Dan Keterampilan Berpikir Kritis Terhadap Penguasaan Konsep Dasar Biologi. *Edusains*, *12*(1), 113–122. https://doi.org/10.15408/es.v12i1.13048

Julian, R., Suparman, S., Djumat, I., Taib, B., Ermawati, E., Sahidun, N., Wibowo, A. P., Sanjaya, F. I., & Sancoko, S. D. (2020). The Analysis and Design of Electronic Student Worksheet Based on the Discovery Learning to Improve Critical Thinking Ability. *Universal Journal of Educational Research*, *8*(12B), 8022–8033. https://doi.org/10.13189/ujer.2020.082603

Junita, I. W., & Yuliani, Y. (2022). Pengembangan E-LKPD Berbasis Etnosains untuk Melatihkan Keterampilan Literasi Sains pada Materi Transpor Membran. *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, *11*(2), 356–367. https://doi.org/10.26740/bioedu.v11n2.p356-367

Kadaritna, N., Rosidin, U., Sari, N. N., & Rakhmawati, I. (2020). Identification of Scientific Literacy of Elementary School Students in Central Lampung District. *Jurnal Pendidikan Progresif*, *10*(1), 133–145. https://doi.org/10.23960/jpp.v10.i1.202014

Kamal, F. A., Subali, B., Astuti, B., Rusilowati, A., & Widiyatmoko, A. (2024). Pengembangan LKPD Digital Berbasis STEM Untuk Meningkatkan Literasi Numerasi Dan Sains Peserta Didik. *Jurnal Penelitian Pendidikan IPA*, *10*(5), 2454–2464. https://doi.org/10.29303/jppipa.v10i5.6689

Kiswanto, R. A., Wardani, S., Sudarmin, & Nurhayati, S. (2024). Pengembangan E-LKPD Bermuatan STEM Terintegrasi Etnosains untuk Meningkatkan Keterampilan Berpikir Kritis Siswa pada Materi Koloid. *Jurnal Kajian Penelitian Pendidikan Dan Kebudayaan*, *2*(1), 10–23. https://doi.org/10.59031/jkppk.v2i1.305

Kristyowati, R., & Purwanto, A. (2019). Pembelajaran Literasi Sains Melalui Pemanfaatan Lingkungan. *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, *9*(2), 183–191. https://doi.org/10.24246/j.js.2019.v9.i2.p183-191

Kriswanti, D. P., & Suryanti, Supardi, Z. A. I. (2020). Pengembangan Perangkat Pembelajaran Berbasis Proyek Etnosains Untuk Melatih Literasi Sains Peserta Didik Sekolah Dasar. *Jurnal Education and Development*, *8*(3), 372–378. Retrieved from https://r.search.yahoo.com/_ylt=AwrPpnkGrjpn HwIACivLQwx.;_ylu=Y29sbwNzZzMEcG9zAzIE dnRpZAMEc2VjA3Ny/RV=2/RE=1733108487/R O=10/RU=https%3a%2f%2fjournal.ipts.ac.id%2fi ndex.php%2fED%2farticle%2fdownload%2f2019 %2f1044%2f/RK=2/RS=kvj8hk.5slUkbXgwRVgB RTTo_xI-

Kusumastuti, R. P., et al. (2019). Pengaruh Keterampilan Berpikir Krtis Terhadap Literasi Sains Siswa. *UPEJ Unnes Physics …*, *8*(3). Retrieved from https://journal.unnes.ac.id/sju/index.php/upej/ article/view/35624%0Ahttps://journal.unnes.i d/sju/index.php/upej/article/view/35624/1466 2

Lathifah, M. F., Baiq Nunung Hidayati, & Zulandri. (2021). Efektifitas LKPD Elektronik sebagai Media Pembelajaran pada Masa Pandemi Covid-19 untuk Guru di YPI Bidayatul Hidayah Ampenan. *JJurnal Pengabdian Magister Pendidikan IPA*, *4*(2), 25–30. https://doi.org/https://doi.org/10.29303/jpmpi. v3i2.668

Lestari, D. D., & Muchlis, M. (2021). Pengembangan e-LKPD Berorientasi Contextual Teaching And Learning (CTL) Untuk Melatihkan Keterampilan Berpikir Kritis Siswa Pada Materi Termokimia Kelas XI SMA. *Jurnal Pendidikan Kimia Indonesia*, *5*(1), 25–33. https://doi.org/10.23887/jpk.v5i1.30987

Lioba, T., Yuniasih, N., & Nita, C. I. R. (2021). Pengembangan E-LKPD Berbasis Aplikasi Liveworksheets pada Materi Volume Bangun Ruang Kelas V SDN Kebonsari 4 Malang. *Seminar Nasional PGSD UNIKAMA*, *5*(1), 307–313. Retrieved from https://conference.unikama.ac.id/artikel/index. php/pgsd/article/view/644

Mahyuny, S. R., Nursamsu, N., Hasruddin, H., & Muslim, M. (2022). Development of Students Worksheet Learning Tools Made by Ethnoscience Based on Science Literacy. *Jurnal Penelitian Pendidikan IPA*, *8*(4), 2294–2301. https://doi.org/10.29303/jppipa.v8i4.1949

Maruti, E. S., & Widuri, M. C. (2023). Peningkatan Proses Berpikir Kritis Siswa Sekolah Dasar dengan Pembelajaran Berbasis Masalah. *EDUSTUDENT: Jurnal Ilmiah Pendidikan Dan Pembelajaran*, *2*(3), 160. https://doi.org/10.26858/edustudent.v2i3.43633

Muhlis, N. F., Rompegading, A. B., Irfandi, R., Yani, A., Nasir, M., Arafah, M., & Rijal, S. (2023). The Validity of Ethnoscience-Based Student Worksheets to Im-prove Student Science Literacy. *Unnes Science Education Journal Accredited Sinta*, *12*(2), 83–89. Retrieved from https://journal.unnes.ac.id/sju/index.php/usej

Nabil, N. R., Wulandari, I., Yamtinah, S., Ariani, S. R. D., & Ulfa, M. (2022). Analisis Indeks Aiken untuk Mengetahui Validitas Isi Instrumen Asesmen Kompetensi Minimum Berbasis Konteks Sains Kimia. *Paedagogia*, *25*(2), 184. https://doi.org/10.20961/paedagogia.v25i2.64566

Naswar, Fifidjaskia, R. (2023). Pengaruh Kemampuan Berpikir Kritis Terhadap Kemampuan Literasi Sains Siswa Kelas Viii Smp Negeri 7 Kota Ternate Pada Konsep Getaran Dan Gelombang Dengan Menggunakan Model Pembelajaran Discovery Learning. *SAINTIFIK@: Jurnal Pendidikan MIPA*, *8*(1), 13–17. https://doi.org/10.33387/saintifik.v8i1.6218

Ningrum, R. A., Qomaria, N., Hadi, W. P., Ahied, M., & Sutarja, M. C. (2024). Kelayakan E-Lkpd Berbasis Literasi Sains Materi Getaran Dan. *Jurnal Natural Science Educational Research, 7*(1), 121–128. Retrieved from https://journal.trunojoyo.ac.id/nser/article/view/14215%0Ahttps://journal.trunojoyo.ac.id/nser/article/download/14215/9524

Niswah, Asih, S. S. (2023). Problem Based Learning Berbasis E-LKPD Untuk Meningkatkan Kemampuan Berpikir Kritis IPA Siswa Kelas V SDN Jatingaleh 02 Semarang. *Kreatif Jurnal Pendidikan Dasar*, *1*(2), 14–25. https://journal.unnes.ac.id/journals/kreat

Nurafriani, R., & Mulyawati, Y. (2023). Pengembangan E-Lkpd Berbasis Liveworksheet Pada Tema 1 Subtema 1 Pembelajaran 3. *Didaktik : Jurnal Ilmiah PGSD STKIP Subang*, *9*(1), 404–414. https://doi.org/10.36989/didaktik.v9i1.711

Nurhasnah, N., Lufri, L., & Asrizal, A. (2022). Effect Size Analysis of the Implications Ethnoscience Approach to the Improvement of 21st Century Skills in Science Learning. *Jurnal IPA & Pembelajaran IPA*, *6*(3), 287–299. https://doi.org/10.24815/jipi.v6i3.26116

Nurjanah, N., & Trimulyono, G. (2022). Pengembangan E-LKPD Berbasis Problem Based Learning untuk Melatihkan Keterampilan Berpikir Kritis pada Materi Hereditas Manusia. *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, *11*(3), 765–774. https://doi.org/10.26740/bioedu.v11n3.p765-774

Nurvitasari, E. et al. (2020). The Use of The Edmodo Application in Blended Learning to Improve Cognitive Abilities of Senior High School Students The Use of The Edmodo Application in Blended Learning to Improve Cognitive Abilities of Senior High School Students. *Journal of Physics: Conference Series PAPER*. https://doi.org/10.1088/1742-6596/1569/4/042048

Odah, A., & Yuniarti, Y. (2023). Budaya Literasi Sekolah untuk Mengembangkan Keterampilan Abad 21. *Basic Edu*, *7*(6), 4193–4203. https://doi.org/10.31004/basicedu.v7i6.6730

Oktaviana, E., Aima, Z., & Ramadoni, D. (2024). Pengembangan E-LKPD Berbasis Project Based Learning (PjBL) Berbantuan Aplikasi Liveworksheet Pada Materi Program Linear Kelas X SMK. *Juring (Journal for Research in Mathematics Learning) P*, *7*(1), 31–044. http://dx.doi.org/10.24014/juring.v7i1.25587

Oktavianto, R., & Aghni, R. I. (2022). Pengembangan E-LKPD Berbasis STEM Untuk Meningkatkan Keterampilan Complex Problem Solving Siswa. *Kajian Pendidikan Akuntansi Indonesia*, *11*(9), 1–16. Retrieved from https://journal.student.uny.ac.id/index.php/kpai/article/view/20062

Parinduri, W. M., Rajagukguk, K. P., & Rambe, N. (2023). Hubungan Kemampuan Literasi Sains Dan Keterampilan Berpikir Kritis Siswa Sekolah Dasar. *School Education Journal Pgsd Fip Unimed*, *13*(2), 191. https://doi.org/10.24114/sejpgsd.v13i2.46215

Pertiwi, U. D., Atanti, R. D., & Ismawati, R. (2019). Pentingnya Literasi Sains Pada Pembelajaran Ipa Smp Abad 21. *Indonesian Journal of Natural Science Education (IJNSE)*, *1*(1), 24–29. https://doi.org/10.31002/nse.v1i1.173

Pertiwi, W. J., Solfarina, & Langitasari, I. (2021). Pengembangan Lembar Kerja Peserta Didik (LKPD) Berbasis Etnosains pada Konsep Larutan Elektrolit dan Nonelektrolit. *Jurnal Inovasi Pendidikan Kimia*, *15*(1), 2717–2730. https://journal.unnes.ac.id/nju/index.php/JIPK/article/view/23228%0Ahttp://eprints.unm.ac.id/13835/

Pratiwi, R. S., & Rachmadiarti, F. (2021). Pengembangan E-Book Berbasis Science, Technology, Engineering, and Mathematics (Stem) Materi Pertumbuhan dan Perkembangan Tumbuhan untuk Melatihkan Keterampilan Literasi Sains. *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, *11*(1), 165–178. https://doi.org/10.26740/bioedu.v11n1.p165-178

Primasari, R., Miarsyah, M., & Rusdi, R. (2020). Science literacy, critical thinking skill, and motivation: A correlational study. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *6*(2), 273–282. https://doi.org/10.22219/jpbi.v6i2.11124

Purnamasari, S., Mapuah, S., & Sunaryo, I. (2021). Pembelajaran Ilmu Pengetahuan Alam Berbasis Etnosains untuk Mengembangkan Kemampuan Berpikir Kritis Siswa Sekolah Dasar. *EduBase : Journal of Basic Education*, *2*(1), 9. https://doi.org/10.47453/edubase.v2i1.284

Rachmawati, N. D., Kurnia, I., & Laila, A. (2023). *Multimedia Interaktif Berbasis Articulate Storyline 3 Sebagai Alternatif Media Pembelajaran Materi Karakteristik Geografis Indonesia di Sekolah Dasar*. *11*(1), 106–121. https://doi.org. 10.22219/jp2sd.v11i1.22316

Rahayuni, G. (2016). Hubungan Keterampilan Berpikir Kritis Dan Literasi Sains Pada Pembelajaran Ipa Terpadu Dengan Model Pbm Dan Stm. *Jurnal Penelitian Dan Pembelajaran IPA*, 2(2), 131. https://doi.org/10.30870/jppi.v2i2.926

Ratnasari, A., & Sumini, S. (2019). Profil Kemampuan Literasi Sains Siswa pada Pembelajaran Sistem Ekskresi. *Prosiding Seminar Nasional Pendidikan "Literasi Sains Pada Era Revolusi Industri 4.0,"* 1–11.

Ridzal, D. A. (2022). The influence of david kolb's learning style on students' biology learning achievement. *Jurnal Pijar Mipa*, *17*(2), 143–147. https://doi.org/10.29303/jpm.v17i2.3261

Ridzal, D. A., & Haswan, H. (2023). Analysis of the correlation between science literacy and critical thinking of grade eight students in the circulatory system. *Jurnal Pijar Mipa*, *18*(1), 1–5. https://doi.org/10.29303/jpm.v18i1.4469

Risamasu, P. V. M., Pieter, J., & Gunada, I. W. (2023). Pengembangan Bahan Ajar IPA SMP Tema Perpindahan Kalor Berkonteks Etnosains Jayapura Papua. *Jurnal Ilmiah Profesi Pendidikan*, *8*(1b), 948–958. https://doi.org/10.29303/jipp.v8i1b.1322

Risdianto, E., Dinissjah, M. J., Nirwana, & Kristiawan, M. (2020). The effect of Ethno science-based direct instruction learning model in physics learning on students' critical thinking skill. *Universal Journal of Educational Research*, *8*(2), 611–615. https://doi.org/10.13189/ujer.2020.080233

Rizkika, M., Putra, P. D. A., & Ahmad, N. (2022). Pengembangan E-LKPD Berbasis STEM pada Materi Tekanan Zat untuk Meningkatkan Kemampuan Berpikir Kritis Siswa SMP. *PSEJ (Pancasakti Science Education Journal)*, *7*(1), 41–48. https://doi.org/10.24905/psej.v7i1.142

Rosari, Y. P. (2022). EJoES. *Educational Journal of Elementary School*, *4*(3), 90–94.

Ruku, E. C., & Purnomo, T. (2020). Validitas lembar kegiatan siswa pada materi perubahan lingkungan untuk melatihkan kemampuan berpikir kritis. *Bioedukasi: Jurnal Pendidikan Biologi*, *9*(1), 1–7. https://jurnalmahasiswa.unesa.ac.id/index.php/bioedu/article/view/32237

Salsabilla, A., Kaniawati, I., & Liliawati, W. (2024a). Development of e-LKPD Based on STEM to Enhance Students ' Critical Thinking Skills on Topic of Renewable Energy. *10*(1). 221-232. https://doi.org/10.29303/jpft.v10i`1.7016

Sani, & Ambarwati. (2024). Pengembangan E-Lkpd Berbasis Problem Based Learning (Pbl) Pada Submateri Upaya Pelestarian Keanekaragaman Hayati Untuk Melatihkan Keterampilan Berpikir Kritis Siswa Kelas X SMA. *13*(2), 323–338. https://doi.org/10.26740/bioedu.v13n2.p323-338

Saputra, A. B., Hamidah, A., & Mataniari, R. (2024). Development of E-LKPD Based on Problem Based Learning on Excretory System Material for High Schools. *Jurnal Penelitian Pendidikan IPA*, *10*(5), 2423–2430. https://doi.org/10.29303/jppipa.v10i5.6935

Sari, R., Harijanto, A., & Wahyuni, S. (2018). Pengembangan Lks Ipa Berbasis Kearifan Lokal Kopi Pada Pokok Bahasan Usaha Dan Energi Di Smp. *Jurnal Pembelajaran Fisika*, *7*(1), 70. https://doi.org/10.19184/jpf.v7i1.7227

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), 124–138. https://doi.org/10.38048/jipcb.v11i1.2315

Shelviana, S., Prasasti, P. A. T., & Listiani, I. (2023). Pengembangan E-LKPD Menggunakan Liveworksheet Pada Materi Sistem Pencernaan Manusia Kelas V Sekolah Dasar. *Al-Madrasah: Jurnal Pendidikan Madrasah Ibtidaiyah*, *7*(4), 1621. https://doi.org/10.35931/am.v7i4.2616

Siagian, G., Exaudi Sirait, D., Veronika Situmorang, M., Verawaty Silalahi, M., Studi Pendidikan Biologi, P., & Studi Matematika, P. (2022). Pengembangan e-LKPD Berbasis Etnosains Untuk Melatih Keterampilan Literasi Sains Pada Materi Zat Makanan. *Jurnal Penelitian Dan Pengabdian Masyarakat Nommensen Siantar (JP2NS)*, *2*(2), 63–87. Retrieved from https://jurnal.uhnp.ac.id/jp2ns-uhnp/article/view/262

Sumanik, Novike Bela, Siregar, lamtiar ferawaty, yenni pintauli pasaribu. (2023). Literature Study: Liveworksheet as a Science Learning Media Electronic Student Worksheet in The Merdeka Curriculum. Technium Social Sciences Journal, 49(1), 374–382. https://doi.org/10.47577/tssj.v49i1.9828

Suparwati, A. M. N., Suja, W., & Tika, N. I. (2023). E-LKPD Kimia Berbasis STEM dengan Muatan Etnosains untuk Meningkatkan Model Mental Kimia pada Materi Laju Reaksi. *Jurnal Pendidikan Kimia Undiksha*, *7*(1), 1–10. https://ejournal.undiksha.ac.id/index.php/JJPK

Suryaningsih, S., & Nurlita, R. (2021). Pentingnya Lembar Kerja Peserta Didik Elektronik (E-LKPD) Inovatif dalam Proses Pembelajaran Abad 21.

Jurnal Pendidikan Indonesia, *2*(7), 1256–1268. https://doi.org/10.36418/japendi.v2i7.233

Sutrisna, N. (2021). Analisis Kemampuan Literasi Sains Peserta Didik SMA Di Kota Sungai Penuh. *Jurnal Inovasi Penelitian*, *1*(12), 2683–2694. Retrieved from https://stp-mataram.e-journal.id/JIP/article/view/530

Sya'diyah, K., Wardani, S., Sumarni, W., & ... (2023). Pengembangan LKPD Berbasis Problem Terintegrasi Etnosains Untuk Meningkatkan Hasil Belajar Kognitif Dan Interpersonal. *Chemistry in in Education*, *12*(1), 58–66. Retrieved from https://journal.unnes.ac.id/sju/index.php/chemined/article/view/59647

Syahputri, D. N., Solikhin, F., & Nurhamidah, N. (2023). Pengembangan e-LKPD Berbasis Discovery Learning untuk Meningkatkan Pemahaman Peserta Didik pada Materi Reaksi Redoks. *Jurnal Inovasi Pendidikan Kimia*, *17*(1), 67–74. https://doi.org/10.15294/jipk.v17i1.37598

Tiara, S. K., & Sari, E. Y. (2019). Analisis Teknik Penilaian Sikap Sosial Siswa Dalam Penerapan Kurikulum 2013 Di Sdn 1 Watulimo. *EduHumaniora | Jurnal Pendidikan Dasar Kampus Cibiru*, *11*(1), 21. https://doi.org/10.17509/eh.v11i1.11905

Tirri, K. (2016). Holistic Perspectives on Gifted Education for the 21st Century. *Giftedness and Talent in the 21st Century*, 101–110. https://doi.org/10.1007/978-94-6300-503-6_6

Umaroh, U., Novaliyosi, N., & Setiani, Y. (2022). Pengembangan Lembar Kerja Peserta Didik Elektronik (E-LKPD) Berbasis Problem Based Learning (PBL) untuk Memfasilitasi Kemampuan Penalaran Peserta Didik pada Materi Lingkaran. *Wilangan: Jurnal Inovasi Dan Riset Pendidikan Matematika*, *3*(1), 61. https://doi.org/10.56704/jirpm.v3i1.13368

Upu, Francis Terseer and Kalu, O. (2024). *VillageMath Educational Review Effects of Ethnoscience Blended Instructional Strategy on Urban and Rural Students ' Interest , Achievement and Retention in Basic Science and Technology in*. *6*(1), 53–65. https://doi.org/10.5281/zenodo.11652618

Wahyuningtyas, D. A., Rohmanurmeta, F. M., & Widyastuti, S. (2023). Improving the Critical Thinking Ability Science through Problem-Based Learning Model Assisted Student Worksheet Ethnoscience. *Jurnal PTK Dan Pendidikan*, *9*(1), 27–36. https://doi.org/10.18592/ptk.v9i1.9002

Walidah, M., Evendi, E., & Rahmatan, H. (2023). Penerapan Lembar Kerja Peserta Didik Berbasis Etnosains untuk Meningkatkan Hasil Belajar di SMP Negeri 8 Banda Aceh. *Jurnal Pendidikan Sains Indonesia*, *11*(1), 84–95. https://doi.org/10.24815/jpsi.v11i1.26854

Wang, Y., Lavonen, J., & Tirri, K. (2018). Aims for learning 21st century competencies in national primary science Curricula in China and Finland. *Eurasia Journal of Mathematics, Science and Technology Education*, *14*(6), 2081–2095. https://doi.org/10.29333/ejmste/86363

Wedy, Z. S., & Desnita, D. (2024). Studi Literatur: Pengaruh Penggunaan Lkpd Berbasis Elektronik Menggunakan Pendekatan Stem Untuk Meningkatkan Keterampilan Abad 21 Peserta Didik. *Silampari Jurnal Pendidikan Ilmu Fisika*, *6*(1), 138–151. https://doi.org/10.31540/sjpif.v6i1.2761

Widyaningrum, R. (2018). Analisis Kebutuhan Pengembangan Model Pembelajaran Berbasis Etnosains Untuk Meningkatkan Kualitas Pembelajaran Ipa Dan Menanamkan Nilai Kearifan Lokal Siswa Sekolah Dasar. *Widya Wacana: Jurnal Ilmiah*, *13*(2), 26–32. https://doi.org/10.33061/ww.v13i2.2257

Wijanarko, T., Ginanjar, S., Febrianti, L., Dewi, A., & Novitasari, S. D. (2024). The Role of Natural Schools in Cultivating 4C Skills to Face the Challenges of the 21st Century. *Jurnal Penelitian Pendidikan IPA*, *10*(3), 1048–1055. https://doi.org/10.29303/jppipa.v10i3.6556

Wijaya, A. K., Sapti, M., & Rizkia Pangestika, R. (2022). Pengembangan E-Modul Bangun Datar Berbasis Teori Multiple Intelligence untuk Siswa Kelas IV SDN Ngupasan. *Jurnal Pemikiran Dan Pengembangan Sekolah Dasar (JP2SD)*, *10*(1), 96–103. https://doi.org/10.22219/jp2sd.v10i1.20249

Wijayanti, D. M., Ahmadi, F., & Sarwi, S. (2019). Keefektifan Mobile Learning Media Bermuatan Ethnoscience terhadap Hasil Belajar Siswa Sekolah Dasar. *MODELING: Jurnal Program Studi PGMI*, *6*(2), 129–136. https://doi.org/10.36835/modeling.v6i2.463

Wildayanto, A., & N, S. E. (2020). Journal of Innovative Science Education Analysis of Science Literation and Scientific Attitude at Temperature and Calor. *Journal of Innovative Science Education*, *9*(2), 151–158.

Wulandari, N. R., Aka, K. A., & Mukmin, B. A. (2023). Pengembangan LKPD Berorientasi Pendekatan Saintifik dengan Aplikasi Liveworksheet Untuk Siswa Kelas IV Sekolah Dasar. *2*(1), 20–27. https://doi.org/10.54259/diajar.v2i1.1295

Yokhebed, Y. (2019). Profil Kompetensi Abad 21: Komunikasi, Kreativitas, Kolaborasi, Berpikir Kritis Pada Calon Guru Biologi Profile of 21st Century Competency: Communication, Creativity, Collaboration, Critical Thinking at Prospective Biology Teachers. *Bio-Pedagogi*, *8*(2), 94. https://doi.org/10.20961/bio-pedagogi.v8i2.36154

Yolida, B., et al. (2023). Pelatihan Perancangan Lembar Kerja Peserta Didik IPA Berbasis Etnosains Bagi Guru SMP. *Jurnal Anadara Pengabdian Masyarakat*, *5*(1). Retrieved from http://jurnal.una.ac.id/index.php/anadara/article/view/3303

Yuliana, I., Cahyono, M. E., Widodo, W., & Irwanto, I. (2021). The effect of ethnoscience-themed picture books embedded within contextbased learning on students' scientific literacy. *Eurasian Journal of Educational Research*, *2021*(92), 317–334. https://doi.org/10.14689/ejer.2021.92.16

Zahroh, D. A., & Yuliani, Y. (2021). Pengembangan e-LKPD Berbasis Literasi Sains untuk Melatihkan Keterampilan Berpikir Kritis Peserta Didik pada Materi Pertumbuhan dan Perkembangan. *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, *10*(3), 605–616. https://doi.org/10.26740/bioedu.v10n3.p605-616

Zakiyah, N. A., & Sudarmin. (2022). Development of E-Module STEM integrated Ethnoscience to Increase 21st Century Skills. *International Journal of Active Learning*, *7*(1), 49–58. http://journal.unnes.ac.id/nju/index.php/ijal

Zikri, T. A., & Handayani, S. (2024). Development of Electronic Student Worksheets Based on Multiple Representations for High School Students on the Topic of Buffer Solutions. *Jurnal Penelitian Pendidikan IPA*, *10*(5), 2521–2529. https://doi.org/10.29303/jppipa.v10i5.5247