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Science Learning Using e-LKPD Ethno-SiMaYang Tapis Lampung Cloth to Improve Critical Thinking Skills

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Abstract: This research aims to explain the effect of using the Etno-SiMaYang Lampung Tapis Cloth e-LKPD in improving students' critical thinking skills. This research is R&D research with the Borg and Gall research model stages 1-7. The samples in this study were class VII.1 as the control class and class VII. 2 as the experimental class, the sample was selected using a cluster random sampling technique. The data collection instruments used were teacher and student needs analysis questionnaires, expert validation questionnaires, teacher and student response questionnaires, as well as pretest-posttest questions. The data analysis technique uses the t-test on students' n-Gain values. The research results stated that the expert validation results for construction suitability, content suitability and readability obtained a percentage score of 85.00% which indicated that the e-LKPD product was valid with the criteria "very high". The average percentage of teacher and student responses was 99.00% and 97.10%, which shows that the e-LKPD product is practical with the criteria "very high". The effectiveness of e-LKPD products in improving critical thinking skills in experimental classes can be seen from the average n-Gain for students of 0.71 in the "large" category with the effect size criteria being in the "large" category.

Keywords: e-LKPD; Ethno-SiMaYang; Lampung Tapis Cloth

Introduction

Advances in science and technology, demographic changes, globalization and the environment are things that influence the current education system (Chuang, 2021). Increasing globalization has led to an ever-expanding and competitive market space (Atiku et al., 2022; Kennedy & Sundberg, 2020). In the modern and continuously developing business world, human resources are a key indicator in achieving organizational goals and competitiveness. Graduates equipped with 21st century skills play an important role in supporting better performance, both in terms of competitiveness and also performance sustainability (Ghafar, 2020).

There are four skills that students must have to face the challenges of the 21st century, namely critical thinking and problem solving, communication, collaboration, creativity and innovation (Trilling & Fadel, 2009). There are three main areas for improving teaching and learning in the 21st century. Basic knowledge is the first key area of improving teaching. Meta-knowledge plays an important role for students, educational meta-knowledge must help students to improve creative thinking, critical thinking, and problem solving, communication and collaboration (Khahro & Javed, 2022).

Critical thinking skills are a process of using rational and reflective thinking skills aimed at making decisions about what to believe or do (Ennis, 1991). Problem solving skills provide direct experience to students so that they can practice their abilities in constructing, understanding and applying the concepts

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that students have learned (Kusnia, 2023). Critical thinking skills are closely related to problem solving because in the problem-solving process students are invited to think in identifying problems, obtain detailed information related to the problems they are facing, and are able to compare two or more information obtained as a problem solving effort (Azizah et al., 2022; Fauziah et al., 2022).

According to the international study Trends in Mathematics and Science Study (TIMSS) which measured students' cognitive abilities in mathematics and science in 2015, Indonesia was ranked 44th out of 47 countries with a score of 397 in the low category (Martin & Mullis, 2019). The assessment instruments used in the TIMSS assessment are questions oriented to critical thinking skills and problem solving in everyday life. Based on the TIMSS results, it shows that the critical thinking and problem solving skills of Indonesian students in science learning are still low. Therefore, it is important to practice critical thinking skills. The Indonesian government is currently also making improvements in the realm of education, one of which is by making changes to the curriculum. The Ministry of Education and Culture is currently planning a curriculum change from the 2013 Curriculum to the Independent Curriculum (Maulia et al., 2024). One of the goals is to practice critical thinking skills. In the Merdeka curriculum, teachers in learning are given the freedom to use various approaches that can stimulate 21st century skills.

Critical thinking and problem solving skills can be improved by implementing a learning approach that is oriented towards improving these skills. The learning approach is used because the learning process focuses on students' activities for discussing, constructing lesson material, practicing thinking, collaborating, and solving problems (Suparsawan, 2020). One approach that can be used in learning is learning based on local wisdom or ethnoscience. It is important to apply ethnoscience learning in 21st century learning, apart from improving critical thinking and problem solving skills, this approach is in accordance with the goals of 21st century education, namely to form students who have global awareness, to understand their own culture and the culture of other countries (Vockley, 2007). Learning local wisdom or ethnoscience is one approach that is being widely studied to be integrated into the curriculum (Elvianasti et al., 2023). Learning based on local wisdom is currently recognized as potential innovative learning. Learning that is linked to local community wisdom with scientific knowledge is very important to implement because it can transform community knowledge that has been passed down from generation to generation into reliable and accountable knowledge (Parmin et al., 2022; Sudarmin et al., 2017). One of the local wisdoms that exists in Indonesia, especially in the Lampung area, is available integrated in science learning is Lampung Tapis Cloth.

Lampung tapis cloth is a Lampung people's woven craft made with cotton thread and gold thread. The process of making Lampung tapis cloth includes four stages, namely making thread, dyeing thread, knitting thread, and embroidering thread to make motifs on tapis cloth (Nurlaili, 2022). The process of making Lampung filter cloth involves a process of changing the material. The yarn coloring process uses a variety of dyes, both natural and artificial. After this process is complete, the waste is then thrown into the river without any separation or processing process so that the river water becomes cloudy, therefore it is necessary to separate the waste mixture so that it does not endanger the river ecosystem or health.

The integration of ethnoscience in learning has been widely implemented in various countries, including Indonesia. Ethnoscience-based learning has been widely studied and has had a positive influence in improving students' critical thinking and problem solving skills (Hikmawati et al., 2020; Kurniawan & Syafriani, 2021; Utaminingsih, 2021). Teaching materials such as LKPD based on an ethnoscience approach are one topic that has been widely developed currently (Pertiwi et al., 2021). In this ever-developing era, teaching materials are needed that accommodate technology. e-LKPD is electronic-based teaching material used in learning to help students understand lesson material. e-LKPD can be in the form of a worksheet or worksheet that can be accessed via an e-learning platform (Syafitri & Tressyalina, 2020). In its application in the classroom, e-LKPD is created by following the syntax of learning models.

The SiMaYang learning model is a multiple representation-based learning model developed by combining the theory of interaction factors (seven basic concepts) which influences students' ability to represent scientific phenomena into the IF-SO model framework (Sunyono, 2015). The SiMaYang learning model is a learning model that has collaborative, cooperative and imaginative characteristics which are stated in the exploration - imagination and internalization phases. It can be used as an alternative learning model that is able to align students with low initial abilities with students with medium and high initial abilities in building mental models and increasing mastery of concepts (Sunyono, 2015).

Based on this, this research will develop teaching materials, namely e-LKPD based on the Lampung Tapis Cloth Etno-SiMaYang to improve students' critical thinking skills.

Method

The research method that will be used in this research is research and development (R & D). The product that will be developed is e-LKPD to improve students' critical thinking and problem solving skills. The research design used in this research is the Borg & Gall (1989) development model which has 10 development stages. The steps that in this research and development is limited to stage 7, namely product refinement as a result of extensive trials. The product produced by the researcher is an e-LKPD based on Etno-SiMaYang Lampung tapis cloth to improve students' critical thinking skills. The procedure for this research can be seen in Figure 1.

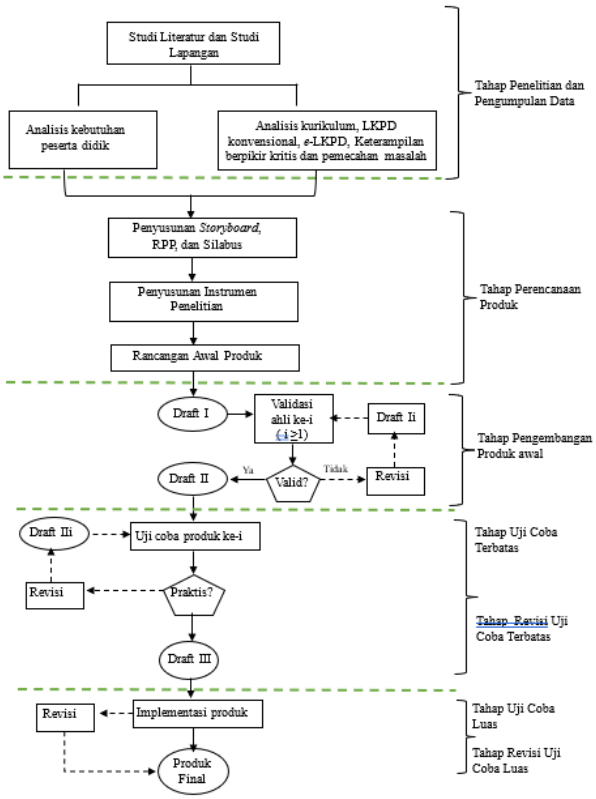

Figure 1. Development Procedure (Sunyono, 2014; Wardani, 2023)

The instruments in this research include a preliminary study questionnaire by teachers and students, an expert validation questionnaire which covers aspects of content suitability, construction suitability, and readability aspects. The aspects of suitability of the Etno-SiMaYang e-LKPD Lampung tapis cloth assessed by the teacher are aspects of content suitability, readability and product attractiveness, while students assess product attractiveness and readability aspects, as well as pre-test and post-test questions on critical thinking skills. The research sampling technique used cluster random sampling technique, so that class VII was obtained. 1 as experimental class and VII. 2 as the control class. The data analysis technique in this research uses questionnaire analysis as a result of expert validation and teacher and student responses and then interprets according to Arikunto (2013), independent sample t-test, and to determine the magnitude of the influence of the Lampung Tapis Cloth Etno-SiMaYang e-LKPD on thinking skills. Critically, the effect size test is used.

Table 1. Validation Percentage Analysis Criteria

Percentage (%)	Validity level	Description
76 – 100	Valid	Worthy/no need for revision
51 – 75	Fairly valid	Decent enough/partial revision
26 – 50	Quite valid	Inadequate/partial revision
< 26	Invalid	Not feasible/total revision

Table 2. Practicality Analysis Percentage Criteria

Percentage (%)	Eligibility level	Deskription
76 – 100	Practical	Practical/no need for revision
51 – 75	Quite practical	Quite practical/partial revision
26 – 50	Less practical	Less practical /partial revision
< 26	Impractical	Impractical /total revision

Result and Discussion

Research and development of products in the form of e-LKPD based on Ethno-SiMaYang Lampung Tapis Cloth was carried out based on the stages of the (Borg & Gall, 2007) development model which include seven steps, namely research information collection, planning, develop preliminary form of product, preliminary field testing, main product revision, main field testing, and operational product revision.

Research Information Collection

Literature studies consist of the results of library studies and the results of curriculum studies. The literature study carried out included reviewing theories regarding e-LKPD, the ethnoscience approach, the SiMaYang learning model by Sunyono (2015) which consists of four syntaxes including orientation, exploration and imagination, internalization, and

evaluation. The indicators of critical thinking skills, which includes aspects of providing simple explanations, building basic skills, concluding, providing further explanations, and organizing strategies and tactics.

The curriculum study carried out includes determining the learning outcomes (CP) that will be achieved. The learning outcomes (CP) that will be achieved are in accordance with the Ministry of Education and Culture's circular on the independent curriculum, namely "At the end of phase D, students are able to classify living creatures and objects based on observed characteristics, identify the properties and characteristics of substances, distinguish physical and chemical changes and separate simple mixtures".

The field study included giving needs analysis questionnaires to teachers and students, teacher interviews, and analysis of the LKPD used at SMPN 1 Way Jepara. The needs analysis questionnaire for e-LKPD based on Etno-SiMaYang tapis cloth in Lampung was filled in by 93 students from 11 junior high schools and 25 teachers in Lampung from 18 junior high schools in Lampung.

Table 3. Survey Results on Teachers' Use of e-LKPD

Questions	Percentage (%)
Have you ever used LKPD when studying material on physical and chemical changes, as well as separating mixtures?	92
Are the LKPDs used self-made?	12
Have you ever used the SiMaYang learning model on physical and chemical changes, as well as separation of mixtures?	4
Have you ever linked classroom learning to Lampung local wisdom?	20
Do you need an ethno-SiMaYang based e-LKPD that can stimulate students' critical thinking and problem solving skills on material separating mixtures and physical and chemical changes?	100

Table 4. Survey Results on the Use of e-LKPD by Students

Questions	Percentage (%)
Have you used mobile phones (HP) in science learning?	79.6
Do you have difficulty understanding physical and chemical changes, as well as the separation of mixtures?	90.3
Does your teacher use learning LKPD in science lessons regarding physical and chemical changes, as well as the separation of mixtures?	92.5
Do you enjoy learning using e-LKPD?	30.1
Does the LKPD material on physical and chemical changes, as well as the separation of mixtures used in learning, highlight Lampung's cultural traditions?	16.1
Is it necessary to develop an ethnoscience-SiMaYang-based e-LKPD to train critical thinking and problem solving skills on material on physical and chemical changes, as well as the separation of mixtures?	95.7

Based on Table 3 and Table 4, information is obtained that both teachers and students need Etno-SiMaYang based e-LKPD to improve critical thinking skills in science learning. The use of e-LKPD in learning has an impact on students' learning activities becoming more enjoyable, learning becomes interactive and allows students to practice learning (Puspita & Dewi, 2021). Learning based on culture or local wisdom can create learning activities that are contextual and real because they are closely related to the context of the environment where students live, so that learning is more effective and students can easily master the material being studied (Basuki et al., 2019). Based on research that has been conducted, it is stated that the SiMaYang learning model can improve critical thinking skills (Setiawan, 2023).

Planning

At this planning stage, teaching modules are prepared, and instruments are prepared in the form of pretest-posttest questions, assessment rubrics, preparation of e-LKPD component plans, expert validation sheets, and the software to be used. The software used to create e-LKPD is Ispring Suite 11.

The results of the e-LKPD component planning are as follows, the introductory section includes a welcome page, log in page, front cover, foreword, table of contents, instructions for using e-LKPD, learning achievement sheet, competency achievement indicators (GPA), and learning objectives. The content section consists of the e-LKPD identity which includes subjects, class and semester, material, sub-material, and time allocation. In the content section there are learning stages that will be carried out in accordance with the

SiMaYang learning model. The latter concluding section includes a bibliography and developer profile.

Develop preliminary form of product

The initial product development stage consists of two parts, namely product creation and product validation by two science expert lecturers.

The product creation stage consists of an introduction, content and conclusion. Introduction section, the initial display of the introductory section is designed to display a welcome greeting and there are directions to press the start button to start learning using the e-LKPD which was developed then continued with the log in page, front cover, foreword, table of contents, instructions for using the e-LKPD, sheet Learning outcomes, competency achievement indicators (GPA), and learning objectives. Then contents section, the content of the Etno-SiMaYang based e-LKPD consists of the e-LKPD identity including subject, class/semester, material, sub-material, time allocation, competency achievement indicators, and 2x40 minute time allocation for each e-LKPD. There are 2 Etno-SiMaYang based e-LKPDs being developed, namely e-LKPD 1 on mixture separation material and e-LKPD 2 on physical and chemical changes material. The latter closing part, the closing section of the developed e-LKPD 1 and e-LKPD 2 consists of a bibliography and developer profile. The bibliography section contains a list of books used as literature in making e-LKPD based on Etno-SiMaYang Lampung filter cloth on the material of separating mixtures and changing materials. The developer profile section contains brief biodata of the e-LKPD developer.

The results of the development of the draft e-LKPD based on Etno-SiMaYang Lampung tapis cloth which has been completed and made in html form is then subjected to expert validation.

Table 5. Expert Validation Results

Validation Aspect	Percentage (%)
Content suitability	85.00
Construction suitability	85.00
Legibility	85.00
Average	85.00

Validation of the content suitability aspect aims to determine the suitability of the material content with learning outcomes (CP) and the suitability of the content of the Etno-SiMaYang based e-LKPD. Assessment of suitability aspects of e-LKPD construction includes construction according to format, Etno-SiMaYang based e-LKPD content construction, Etno-SiMaYang based e-LKPD content construction, mixed separation, and Etno-SiMaYang based e-LKPD content construction based on physical and chemical changes. According to Jannah et al. (2017), validation of the readability aspect aims to determine the readability of e-LKPD related to ease and understandability.

Based on Table 5, information is obtained that the Etno-SiMaYang based e-LKPD product is valid and practical with very high criteria. Based on the validation results, the average expert validation was 85.00% and was declared valid in the "very high" category with several suggestions for improvement from the validator. This means that the LKPD developed can help in the students' learning process (Sarita & Kurniawati, 2020).

Preliminary field testing

The improved Etno-SiMaYang based e-LKPD product was then tested in a limited field test with 15 students and 3 science teachers at SMPN 1 Way Jepara as the subject.

Table 6. Teacher Response Results

Aspect	Percentage (%)
Content suitability	99.00
Legibility	100.00
Attractiveness	100.00
Average	99.99

Table 7. Results of Student Responses

Aspect	Percentage (%)
Legibility	96.30
Attractiveness	97.90
Average	97.10

Based on Table 6, information is obtained that according to three science teachers at SMPN 1 Way Jepara in terms of content suitability and readability aspects, the Etno-SiMaYang-based e-LKPD product of Lampung tapis cloth that was developed is good, appropriate and feasible in the very high category and so on. can be tested on a larger sample.

Based on Table 7, information was obtained that according to 15 students at SMPN 1 Way Jepara in terms of readability and attractiveness aspects, the Etno-SiMaYang based e-LKPD product of Lampung tapis cloth that was developed was appropriate, attractive, and suitable for use in science learning in the very category Good.

Main product revision

The results of teacher and student responses presented previously show that the Etno-SiMaYang based e-LKPD from Lampung tapis cloth that was developed received very high criteria. Overall there are no suggestions from teachers and students for improvement so that there is no need for revisions to the e-LKPD development results. Based on this, the e-LKPD based on Etno-SiMaYang Lampung filter cloth to improve critical thinking skills on the material of

separating mixtures and material changes that was developed can be said to be suitable and feasible for testing on a larger number of samples.

Main field testing

The main field test stage is the stage of implementing the development product, namely e-LKPD based on Etno-SiMaYang Lampung tapis cloth at SMPN 1 Way Jepara. Before conducting the research, the researcher tested the validity and reliability of the pretest-posttest questions. After the questions are declared valid and reliable, the pretest-posttest questions can be tested on students. The effectiveness of the Etno-SiMaYang-based e-LKPD product, Lampung tapis cloth, can be seen from the n-Gain value of students, the percentage achievement of critical thinking skills indicators, and the effect size.

Table 8. Average pretest-posttest score for critical thinking skills in the control class and experimental class

Research Class	Average value		Pretest-posttest increase
	Pretest	Posttest	
Control	40.29	69.80	29.51
Experiment	42.35	84.31	41.96

Based on Table 8, it can be seen that the critical thinking skills of students after implementing learning using e-LKPD based on Etno-SiMaYang Kain Tapis Lampung are better than those implemented using conventional e-LKPD. The increase in pretest-posttest scores for critical thinking skills is also shown through the n-Gain value which is calculated based on the formula and criteria proposed by Hake (2002).

Table 9. Average n-Gain value of critical thinking skills in the control class and experimental class

Research Class	Average value n-Gain	Criteria
Control	0.48	Currently
Experiment	0.71	High

Based on Table 7, information is obtained that the average n-Gain value in the experimental class is higher than the control class. The experimental class had an average n-Gain value of 0.71 in the "high" category, while the average n-Gain value for the control class was 0.48 in the "medium" category". Next, to find out the percentage of each indicator of students' critical thinking skills in the control and experimental classes, you can see in Figure 2.

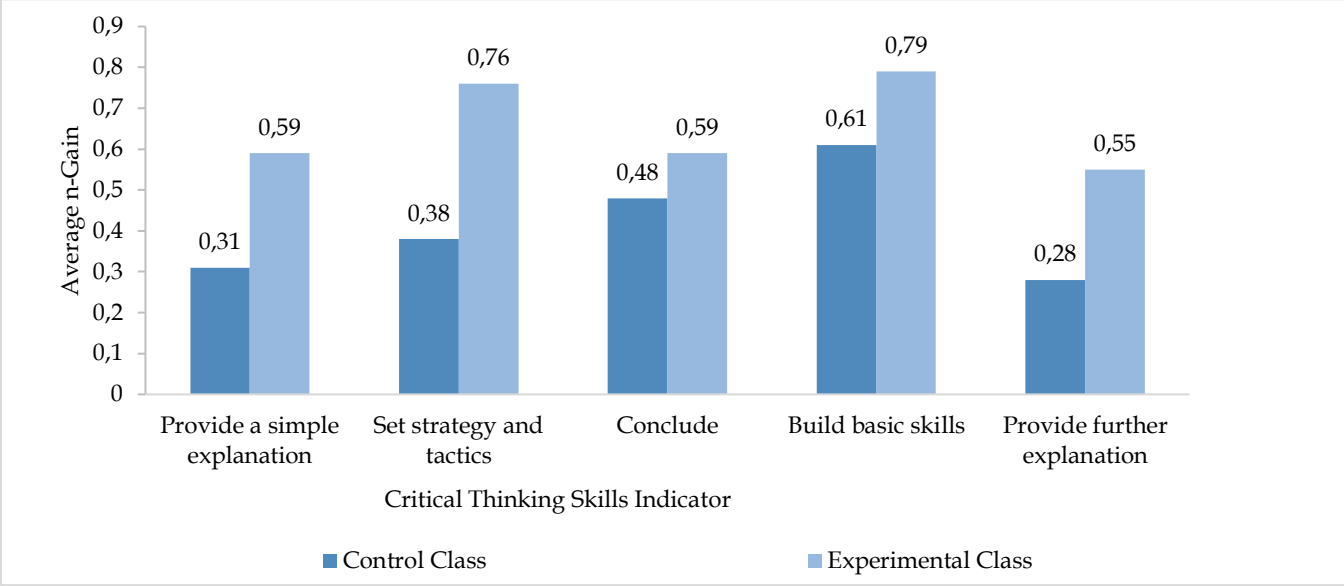

Figure 2. Average n-Gain of Each Critical Thinking Skills Indicator

Based on Figure 2, Information was obtained that the average n-Gain for each indicator of students' critical thinking skills in the experimental class was higher compared to the control class. Average n-Gain indicator of critical thinking skills which has the highest average is building basic skills. This indicator is trained at the exploration-imagination stage. In e-LKPD 2, students are asked to write down the results of observations regarding the practicum that has been carried out. In the practicum process, students are asked to identify appropriate evidence and observation results, provide the most appropriate arguments, answers lead to concepts, show in-depth understanding of concepts (Sundari & Sarkity, 2021).

Hypothesis testing is carried out to prove the hypothesis proposed in the research. Hypothesis testing in this research was carried out using the normality test, homogeneity test, and difference between two means

test. This test uses the n-Gain value to find out whether there is a difference in the average n-Gain value of the critical thinking and problem solving skills of experimental class and control class students.

Table 10. Critical Thinking Skills Normality Test Results

Research Class	N	n-Gain	
		Sig. Test of Normality Kolmogorov-Smirnov	Test Criteria
Control	34	0.200	sig. > 0.05
Experiment	34	0.109	

Based on Table 10, information is obtained that both the control class and the experimental class have sig. > 0.05. This shows that the test decision accepts H_0 and rejects H_1, which means the research data is normally distributed.

Table 11. Homogeneity Test Results of Critical Thinking Skills

Research Class	N	*n-Gain*	
		Value *Sig.*	Test Criteria
Control	34	0.251	*sig.* > 0.05
Experiment	34		

Based on Table 11, information is obtained that both the control class and the experimental class have sig. > 0.05. This shows that the test decision to accept H_0 and reject H_1 means that the research data obtained has homogeneous variations. Because the research data is normally distributed and homogeneous, the test was continued with a parametric test using the independent sample t-test.

Table 12. Test results of the difference between the two average n-Gain scores of students' critical thinking skills

Research Class	N	Df	Sig. *(2-tailed)*	Test Criteria
Control	34	66	0.000	*sig.* < 0.05
Experiment	34		0.000	

Based on Table 12, the results of the difference test between the two averages of the n-Gain value of students' critical thinking skills in the two research classes show a sig. (2-tailed) of 0.000 < 0.05 so that the test decision is to accept H_1 and reject H_0, which means the average n-Gain value of students' critical thinking skills who applied learning using Etno-SiMaYang based e-LKPD compared to the average n-Gain value of students' problem solving in the control class where conventional e-LKPD was applied. This is in accordance with research conducted by Wardani (2023) which states that learning using loud ethnoscience improves students' scientific literacy skills. The stages of the SiMaYang learning model have also been shown to improve students' critical thinking and problem solving abilities (Nurmala et al., 2023; L. Puspita et al., 2020).

To find out how much influence the Etno-SiMaYang-based e-LKPD of Lampung tapis cloth has in improving students' critical thinking skills, an effect size calculation was carried out. The results of the effect size test are shown in Table 13.

Table 13. Test results measure the influence of students' critical thinking skills

Research Class	N	Df	t_{count}	μ^2	Criteria
Control	34	33	-9.630	0.86	Large
Experiment	34	33	-15.758	0.93	Large

The results of the effect size calculation analysis show that 93% of the high critical thinking skills of the experimental class were influenced by learning using e-LKPD based on Etno-SiMaYang Lampung tapis cloth, while 86% of the low critical thinking skills of students in the control class were influenced by learning using conventional e-LKPD.

The "large" criteria in the experimental class and control class have different meanings. The major criteria in the control class are interpreted as a negative category, meaning that the learning process in class using conventional e-LKPD reduces students' critical thinking skills because when learning using conventional e-LKPD makes students listen more to the teacher's explanations, in conventional learning the teacher does not fully integrate the material with the students' environment (Dewi et al., 2019). In conventional learning, students are given practice questions that are product-oriented rather than process-oriented (Siahaan et al., 2022). The large criteria in the experimental class are interpreted as a positive large category, meaning that the learning process in class using e-LKPD based on Etno-SiMaYang tapis cloth from Lampung improves students' critical thinking skills. This is because learning using e-LKPD based on Etno-SiMaYang tapis cloth from Lampung makes students Students are interested in learning because it relates to their own regional identity, thereby encouraging students to actively discuss (Dewi et al., 2021).

Conclusion

Based on the findings that have been made, The results of expert validation on aspects of suitability of content, construction and readability of the Etno-SiMaYang based Lampung filter cloth e-LKPD to improve students' critical thinking skills which were developed had an average percentage with the criteria "very high". The practicality results for the Etno-SiMaYang based e-LKPD of Lampung tapis cloth to

improve critical thinking skills developed have an average percentage with the criteria "very high" so it is said to be practical. This shows that the e-LKPD developed can be used as teaching material in science learning in class by teachers and students. Based on the results of extensive trials of the Etno-SiMaYang based e-LKPD, the Lampung tapis cloth developed was effective in improving students' critical thinking and problem solving skills. This is shown by the average n-gain of critical thinking skills of experimental class students being higher than that of the control class, and supported by the large effect size value of the experimental class of 93.00% of critical thinking skills with "large" criteria.

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Author Contributions
L.S contributed to collecting data, analyzing data, and writing the draft article. S, V, and D. L. guided the implementation of research, writing articles, providing input on draft articles, and reviewing articles.

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Conflicts of Interest
No conflict of interest.

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