

Development of Interactive Learning Media Based on Lamang Tapai Ethnoscience in Science Material as an Effort to Increase Students' Sustainability Awareness

Atiqah Ulya Hayandi¹, Siti Sriyati^{1*}, Diana Rochintaniawati¹, Sasi Sabila Musakinah Ramadhany²

¹Department of Science Education, Faculty of Mathematics and Science Education, Universitas Pendidikan Indonesia, Bandung, Indonesia.

²Department of Economic and Trade International, Faculty of Economics, Yibin University, Yibin, China.

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Corresponding Author:

Siti Sriyati

sriyati@upi.edu

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Abstract: The purpose of this study was to develop interactive learning media based on Lamang Tapai ethnoscience that is valid to increase students' sustainable awareness compared to PPT media used in schools. The research method used is development with the DDR model. The research sample was grade IX students consisting of 30 control class students and 30 experimental class students. The research instruments were media feasibility questionnaires and sustainable awareness questionnaires. The media feasibility questionnaire consisting of material feasibility, learning design, media design and communication was used to validate the media by 5 validators. Sustainable awareness measures 3 indicators, namely behavioral and attitudinal awareness, emotional awareness and practical awareness, all categories are measured based on three aspects of ESD, namely environmental aspects, social aspects, and economic aspects totaling 22 statements. The results of the study showed that the interactive media developed had an average validity value of > 3.00 which means that the interactive media was feasible and very valid, while sustainable awareness in the experimental class reached a value of 90.74 higher than the control class, which was 82.08. This shows that interactive media is declared valid and increases students' sustainable awareness better than PPT media commonly used by teachers.

Keywords: Interactive learning media; Ethnoscience; Sustainability awareness

Introduction

The 21st century is marked by very rapid developments in technology, communication and information (Utami et al., 2023; Wijaya et al., 2016). Digitalization itself is a process of transformation or transfer of activities that were initially conventional to become digital-based which is implemented comprehensively (Maisarah & Prasetya, 2023). In this century, teachers are required to combine conventional learning and digital-based learning using technology

during classroom learning by implementing digital innovation in the learning process. Digital innovations that can be carried out by teachers include the development of teaching materials and learning media (Alika & Radia, 2021; Agustin et al., 2020; Maisarah & Sakulpimolrat, 2022).

In line with the transformation of educational demands in the 21st century, the rapid flow of globalization is currently also a very big challenge in the world of education (Syarif, 2019). The impact of the flow of globalization has a significant impact on all aspects of

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life, including education and culture. This can cause the loss of the original culture of a region, the fading of cultural preservation values, the loss of family values in students, and a decrease in love for the culture they have (Suneki, 2012). Local wisdom is also often ignored and considered irrelevant to the present, let alone the future (Affandy, 2019). As an Indonesian nation that has local wisdom consisting of diverse cultures, customs, languages, and traditions, we should be able to preserve and maintain the existing heritage (Korniadi, 2019; Priyatna, 2016). These conservation efforts are an effort to maintain for a very long period of time and require the development of conservation as a form of sustainable efforts (Lestari, 2025). One way that can be done to face these challenges is to increase the sustainable awareness that students must have, so that students can get to know more and have a sense of ownership of their culture and the culture remains sustainable and is not eroded by the strong currents of globalization (Rohmah et al., 2023; Sulhan, 2018).

According to Hassan et al. (2010), the categories of sustainable awareness consist of 3 categories, namely: sustainability practice awareness, behavioral and attitude awareness, and emotional awareness. Sustainable awareness is closely related to one of the competency standards of the independent curriculum currently used in Indonesian educational units (Haris et al., 2023; Zulkarnaen et al., 2023). The educational goals and competency standards of Indonesian student graduates are in line with the objectives of sustainable awareness competencies (Frank & Stanszus, 2019; Giangrande et al., 2019; Kurnia et al., 2020). The independent curriculum is implemented in all subjects at the junior high school/Islamic junior high school level, one of which is the Natural Sciences (IPA) subject. The science learning process emphasizes providing direct experience to develop competencies so that students can explore and understand the natural environment scientifically (Sutrisna & Gusnidar, 2022). This learning experience can be implemented with a learning approach called the ethnoscience approach.

The ethnoscience approach is here to overcome current challenges. By using the ethnoscience approach, it is hoped that students can learn contextually and use the environment as a learning resource (Fazrul et al., 2022; Sari et al., 2023). This ethnoscience-based learning aims to guide students in discovering and constructing their own knowledge and can help provide context and resources for student learning by integrating culture as a material in learning (Sari et al., 2024; Wiwin & Sudarmin, 2015). Each ethnic group has different local wisdom characteristics which consist of various areas of life such as language, dance, medicine, agriculture, including regional specialties (Lipikuni & Sill, 2024; Sriyati et al., 2021). Therefore, the introduction of

ethnoscience-based teaching materials in learning is very necessary, one of which is the traditional food lamang tapai which originates from West Sumatra which can be studied and linked to science learning in junior high schools.

Lamang tapai can be associated with the concept of biotechnology, substances and their changes, temperature and heat, and the structure and function of the bodies of living things. There are several examples of the application of the concept of science material contained in the process of making lamang tapai, namely the concept of biotechnology and the concept of substances and their changes found in the fermentation process of black glutinous rice tapai which is one example of chemical change, where yeast changes carbohydrates in black glutinous rice into alcohol and acid. Another example is in the concept of temperature and heat, there is a transfer of heat when bamboo containing glutinous rice is burned, there is a transfer from the fire to the bamboo containing white glutinous rice, where the heat from the fire will cause the temperature in the bamboo to increase so that it will make the white glutinous rice cooked into lamang. burning lamang which is classified as cooked in the fermentation process of black glutinous rice tapai is one example of a chemical change.

By integrating local wisdom into science learning, it is hoped that it will increase the sense of awareness of the sustainability of the values of preserving local wisdom in their area. The integration of ethnoscience is very important to implement because in this era of globalization, the younger generation has been exposed to the influence of Western culture, but they are not yet deeply aware of the impact of this. The integration of ethnoscience with learning will give students a deeper understanding of their cultural background with the subject matter being taught (Branch, 2020; Gondwe & Longnecker, 2015) and will make students have more empathy, respect, and increase their understanding of culture (Rahmawati & Ridwan, 2017).

Analysis of student needs in the field was also conducted by researchers on 31 ninth grade students at a junior high school in Padang City using a questionnaire instrument consisting of 17 statements related to the science learning process at school, the use of media in science learning, and the ethnoscience approach in science learning. The results of the analysis showed that only 28% had ever studied science associated with local cultural elements, while 72% of students had never studied. As many as 92% of students strongly agreed that science learning was associated with local cultural elements. As many as 90% of students stated that they needed interactive learning media in the science learning process to make the learning process more interesting.

Based on preliminary studies that have been conducted on students in the field, it can be concluded that there is still a lack of interactive learning media based on ethnoscience or local culture that can train and increase students' sustainability awareness of cultural preservation and students really need the development of such interactive learning media. The use of media in learning can improve student learning outcomes, as a tool to create an effective learning atmosphere, which can be used as a tool to support students' learning experiences (Alika & Radia, 2021; Fajri et al., 2024; Neumann & Merchant, 2022; Ogan et al., 2020). Not only that, but learning media can also improve skills, overcome the limitations of students' experiences, increase students' interest and motivation in learning (Bakhri et al., 2023; Hardiyansyah et al., 2019; Rosydiana et al., 2023).

Based on the description above, it is necessary to conduct research on the development of interactive learning media based on lamang tapai ethnoscience on science material as an effort to increase students' sustainability awareness. This interactive learning media can be claimed as a product that contains

elements of novelty, because based on the literature study conducted, there have not been many interactive learning media products based on ethnoscience that can train and increase students' sustainability awareness of cultural preservation. This research is also considered to provide a good contribution to the development of science in junior high schools, especially in science subjects that can increase students' sustainability awareness.

Method

This research method is a development research that produces interactive learning media products based on lamang tapai ethnoscience. This research is a type of Design and Development Research (DDR) research. There are six stages of design and development research as stated by Ellis & Levi (2010), namely identifying the problem, describing the objectives, designing and developing artifacts, testing artifacts, evaluating testing results, and communicating the testing results as illustrated in the following chart.

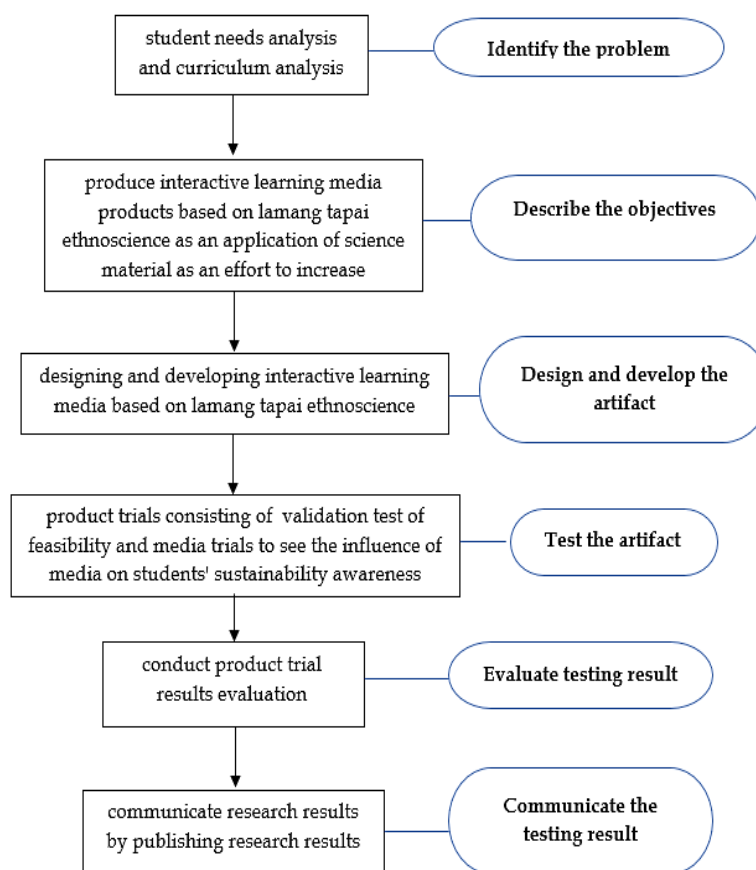


Figure 1. Research procedures

The population in this study were all ninth grade students at one of the State Junior High Schools in Padang City and the sample in this study was 60 ninth grade students consisting of 2 classes where one class was used as an experimental class using interactive learning media, while the other class was used as a control class using learning media commonly used in schools, namely PowerPoint.

After the product development process is carried out, the next step is to conduct a media validity test. First, the interactive learning media validity test was carried out by 5 validators consisting of material experts and media experts. The validity criteria used in assessing the validity of this Lamang Tapai ethnosience-based interactive learning media are seen from the average assessment of all aspects consisting of material aspects, learning design, media and learning communication, and implementation power and user response with a Likert scale that has a score of 1 to 5. The detailed media validity criteria can be seen in Table 1 below.

Table 1. Media validity criteria

Average score	Criteria
> 3.00 and no conceptual errors	Very valid
3.00 and no conceptual errors	Valid
< 3.00 and there are conceptual errors	Invalid

(Chaeruman, 2015)

Then, a trial of interactive learning media was conducted on 30 students in the experimental class. To analyze the effect of interactive learning media based on lamang tapai ethnosience on sustainable awareness, a trial was conducted on 30 students in the experimental class and 30 students in the control class using the PowerPoint media commonly used by teachers in class. The instrument used in this study was a sustainability awareness questionnaire adapted from Hassan et al. (2010). This questionnaire consists of 22 statements consisting of three categories of sustainable awareness. Where in all categories sustainability awareness is measured based on three main aspects of Education for Sustainable Development (ESD), namely environmental aspects, social aspects, and economic aspects. Positive and negative statements in this questionnaire have opposite interpretations (Taluke et al., 2019). Before being used, the questionnaire was tested for validity and reliability using the SPSS application.

The indicators of sustainable awareness measured consist of behavioral and attitude awareness, sustainability emotional awareness, sustainability practice awareness (Clarisa et al., 2020; Muthia et al., 2021). The data will then be analyzed descriptively using the mean and percentage, referring to the level of sustainable awareness contained in Table 2 below.

Table 2. Sustainability awareness level

Mean	Category
1.00 – 2.00	Low
2.01 – 3.00	Medium
3.01 – 4.00	High

(Rini & Nuroso, 2022)

The data is then made into a percentage in the following manner:

$$\text{Percentage (\%)} = \frac{\text{Total Scores Obtained}}{\text{Maximum Score}} \times 100\% \quad (1)$$

(Clarisa et al., 2020)

The percentage results of the sustainability awareness questionnaire can be adjusted to the sustainability awareness categories in Table 3 below.

Table 3. Sustainability awareness category

Average (%)	Category	Meaning
0.0 – 50.0	Low	Practice that seldom or dislike to be done
51.00 – 70.0	Medium	Practice that are done/happened moderate/medium
71.0 – 100.0	High	Practice/feelings that are most likely one/happened

(Hassan et al., 2010)

Result and Discussion

The development of interactive learning media based on lamang tapai ethnosience was developed through several stages, namely:

Problem Identification Stage

At this stage, the researcher focuses on identifying the needs of the media users developed, namely students. This stage aims to identify problems that arise in the learning process, then the researcher compiles the specifications of the learning media products needed. Identify the Problem, namely identifying research problems by analyzing the differences between the competency demands expected from a learning process and real conditions in the field. At this stage, conditions in the field were found, namely that ethnosience-based science learning is still very little implemented in science learning in junior high schools in Padang City. Therefore, students really hope for the development of learning resources that can facilitate students to practice and increase sustainability awareness and ethnosience-based learning.

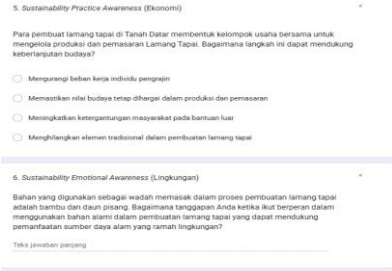
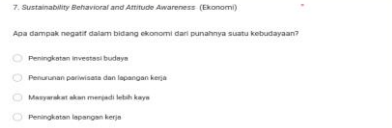
Stage of Describing the Goal

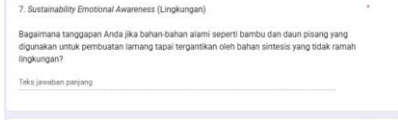
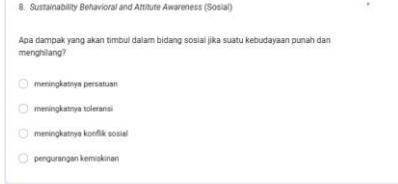
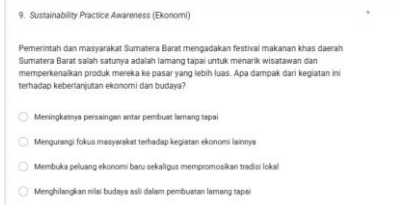
As a solution to the problems raised in this study, interactive learning media based on lamang tapai ethnosience was designed and developed.

Product Design and Development Stage

At this stage, the first step taken is to design interactive learning media based on lamang tapai ethnoscience according to the results of the media needs analysis. The design will be realized in the form of a media storyboard. The product development stage is carried out based on the design that has been prepared, including the creation of interactive learning media based on lamang tapai ethnoscience. The development of interactive learning media based on ethnoscience was developed using the Canva software application. The development of this interactive learning media was developed based on the achievements of science learning stage D of class IX SMP. The results of the development of interactive learning media based on lamang tapai ethnoscience can be seen in Table 4 below.

Table 4. Display and explanation of interactive learning media

Display	Explanation
	Cover contains title, theme, developer profile, button to start media.
	The main menu consists of 5 menu options that can be accessed by the user, namely: - Instructions for use - Learning objectives - Introduction - Materials - Practicum
	This interactive learning media contains practice questions 1 to 5 which aim to evaluate student mastery.
	For each material studied. These practice questions contain questions developed based on sustainability awareness indicators.
	

Display	Explanation
	
	
	

The developed interactive learning media based on lamang tapai ethnoscience has several characteristics, namely the material is presented through contextual ethnoscience-based learning, learning activities contained in the interactive learning media train students' sustainability awareness, interactive learning content, and responsiveness to feedback.

Product Trial Phase (Test the Artifact)

At the product trial stage, the interactive learning media based on lamang tapai ethnoscience that has been developed consists of several stages, namely media validity testing and media trials to see the influence of the media on students' sustainability awareness.

Validity Test

After the interactive learning media is developed, the next step is to conduct a feasibility test of the interactive learning media to experts consisting of 5 expert validators. The results of the validation of the interactive learning media can be seen in Table 5.

Table 5. Interactive learning media validation results

Assessment aspects	Average score	Interpretation
Material	3.75	Very valid
Learning design	4.28	Very valid
Learning communication	4.42	Very valid

The feasibility of interactive learning media based on lamang tapai ethnoscience based on the results of the validity test has a very valid category with a total average value of interactive learning media validity of 4.15 from the highest average value of 5 with a percentage of 83% consisting of several assessment aspects including material assessment aspects with an average score of 3.75 with a very valid category used, then the learning design aspect with an average score of

4.28 with a very valid category used, then the media and learning communication assessment aspect with an average score of 4.42 with a very valid category used. Overall, the results of the interactive learning media validation are categorized as very valid. The decision whether the learning media is valid or not is obtained from the average score if the value is ≥ 3 then the media is declared valid for use.

Media Trial

At this stage, a trial of the implementation of interactive learning media based on lamang tapai ethnoscience that has been developed was conducted to determine the effect of interactive learning media on students' sustainability awareness. The sustainability awareness questionnaire was filled out by students after the learning process was completed. For the analysis of this variable consists of descriptive analysis in the form of analysis of the level of sustainability awareness and analysis of the percentage of sustainability awareness and also conducted an analysis of the frequency of student answers. The profile of student sustainability awareness on each sustainability awareness indicator is presented in a graph in Figure 2 below.

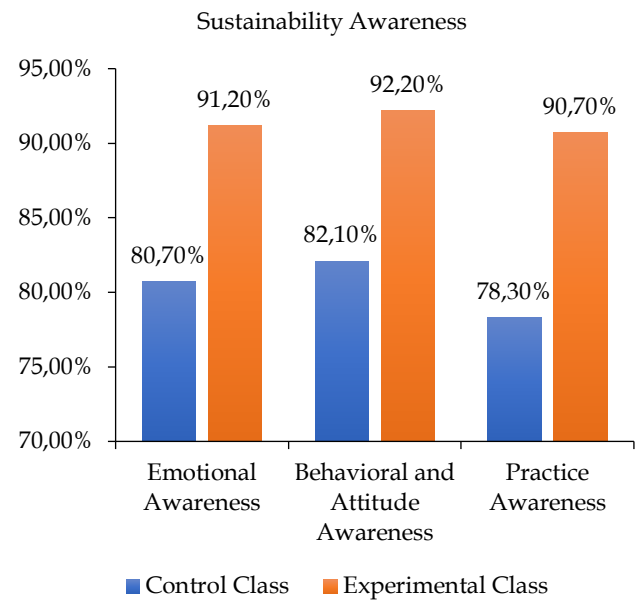


Figure 2. Sustainability awareness in each indicator

In the graph in Figure 2 above, it can be seen that in the experimental class, the behavioral and attitude awareness indicators on sustainability awareness have the highest percentage among other indicators and are higher than the percentage in the control class, which is 92.20%, which indicates that students have the highest sustainable awareness related to their behavior and attitudes towards cultural preservation. While in the control class it is 82.10%. Furthermore, the emotional

awareness indicator in the experimental class has a higher percentage than the control class, which is 91.20%, while in the control class it is 80.70%, which shows that the level of awareness of students in the experimental class is higher regarding the introduction and management of emotions related to the issue of cultural preservation for sustainability. Finally, the practice awareness indicator of students in the experimental class is higher than the control class, which is 90.70% in the experimental class and 78.30% in the control class, this shows that students' awareness of sustainable practices related to cultural preservation in the control class has a higher level than the control class.

The results of the analysis for the emotional awareness indicators in the experimental and control classes can be seen in Table 6 below.

Table 6. Percentage of emotional awareness indicator

Class	Average Percentage (%)	Category
Control	80.71	Practice/feelings that are most likely one/happened
Experimental	91.19	Practice/feelings that are most likely one/happened

Based on the data in Table 6, it is known that the emotional awareness indicator in the experimental class shows a percentage of 91.91%, which means that students in the experimental class often or always carry out the habit of continuous awareness on the emotional awareness indicator, while in the control class it shows a lower percentage of 80.71%. The results of the analysis for the behavioral and attitude awareness indicators in the experimental and control classes can be seen in Table 7 below.

Table 7. Percentage of behavioral and attitude awareness indicators

Class	Average Percentage (%)	Category
Control	82.08	Practice/feelings that are most likely one/happened
Experimental	92.22	Practice/feelings that are most likely one/happened

The overall percentage value for the behavioral and attitude awareness indicator in the experimental class was higher than that in the control class, which was 92.22% in the experimental class and 78.33% in the control class. This generally illustrates that students in the experimental and control classes often carry out habitual activities related to awareness of attitudes and behavior routinely/often towards cultural preservation. Furthermore, the results of the analysis for the practice awareness indicator in the experimental and control classes can be seen in Table 8 below.

Table 8. Percentage of practice awareness indicators

Class	Average Percentage (%)	Category
Control	78.33	Practice/feelings that are most likely one/happened
Experimental	90.74	Practice/feelings that are most likely one/happened

In the practice awareness indicator (sustainability practices), the overall percentage value for the practice awareness indicator (sustainability practices) in the experimental class is higher than the control class, which is 90.74% in the experimental class and 78.33% in the control class. This generally illustrates that students in the experimental class more often carry out attitudes and behaviors of routine/frequent practices towards cultural preservation compared to the control class. The findings of this study are supported by the results of research conducted by Ridwan et. Al. (2020) and Zulkarnaen et al. (2023), regarding students' sustainability awareness being in the high category with a percentage of > 70%. Research conducted by Khoiri et al. (2023) and Ridwan et al. (2020) also showed the same results as the findings of this study, namely that the lowest sustainability awareness category among other categories is in the sustainability practice awareness indicator.

Conclusion

Based on the results of the study, it can be concluded that the interactive learning media based on lamang tapai ethnosience that was developed is very valid with an average score on all aspects of validity of 4.15 and can increase students' awareness of sustainability. Where the percentage of students' awareness of sustainability in the experimental class reached a value of 90.74, higher than the control class of 82.08. This shows that interactive learning media based on lamang tapai ethnosience is very valid for use and can increase students' awareness of sustainability better than media in the form of PPT that is usually used by teachers in schools.

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Author Contributions

Main author and researcher of the article, A.U.H.; information collection, creation of tools to measure needs and responses, creation of expert validation assessments for materials and media, creation of evaluations, creation and testing of research

products, data processing and writing of the initial article, A.U.H.; research and second author of the article, S.S. & D.R.; validation of instruments and initial product design before submission to expert validators for media and materials, supervisor who directed and guided the first author, S.S. & D.R.; translator, S.S. and M.R.

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Conflicts of Interest

The author declares no conflict of interest.

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