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Research Paper

Development of Ethnoscience-Oriented Multimedia Learning Process of Salt Making on Conductivity Materials on the Response of Junior High School Students

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Abstract: Chemistry learning at the junior high school level has not discussed in depth the material presented. Students tend to like science learning without formulas or calculations which make it difficult for students to understand chemistry. The solution that can be given is to develop learning media in the form of multimedia learning based on salt ethnoscience on conductivity material. The purpose of this study was to obtain an ethnoscience study of conductivity material and to find out students' responses to the media. This research uses a descriptive qualitative method with ADDIE development model. The research location is in one of the salt ponds in Bangkalan Regency and in SMP Negeri 2 Kamal. The sampling method was simple random sampling as many as 10 students of class VII. Data collection techniques using interviews, questionnaires, and documentation. The percentage of student responses on the display aspect is 97.33% and the material aspect is 94.25% which is included in the very positive criteria.

Keywords: Multimedia learning; ethnoscience; science learning.

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INTRODUCTION

Science learning can cover the fields of biology, physics, and chemistry. Science learning related to chemistry at the Junior High School level is not discussed in depth so students only get basic knowledge. Based on the results of interviews with junior high school science teachers, it was explained that students prefer to learn science without formulas or calculations such as in the fields of physics and chemistry. This is also in accordance with the identification of problems found in research Hsiung's (2018) which explains that science lessons related to chemistry are often considered as challenging and boring science for students. The problem is due to the existence of traditional teaching methods, the lack of interaction between teachers and students, and the use of static textbooks. Black (2020) explains that the National Science Foundation estimates that 80% of the jobs available over the next decade will require math and science. Lee et al. (2021) also explained that although research findings regarding advances in mobile technology to improve student learning outcomes are generally promising, basically there are still significant gaps in how students can use digital devices to learn chemistry. The decline in students' interest in science is also a problem. As described by Baharom et al. (2020) that the application of traditional, passive and teacher-oriented learning methods can be the cause of a decline in student interest in learning. Although there is learning that has been supported by digital tools, it is not completely clear

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(Hillmayr et al., 2020). Such as the problems encountered in the field, namely students prefer to access the use of the internet by finding out things that are not related to learning but such as information that is trending over time.

Ethnoscience is a cross-disciplinary science, which can be collaborated using various subject areas, be it science, social, and mathematics (Nurhayati, 2021). Learning science that attention to local cultural wisdom as national identity, character, and local cultural customs can be said to be learning approach to ethnoscience (Hadi & Ahied, 2017). The importance of ethnoscience learning for students can make it easier to understand the material obtained and can increase knowledge of the relationship between indigenous science and scientific science based on local culture around the environment. Students need to be given knowledge related to local culture including rituals, customs and others. Based on this, the importance of learning science with an ethnoscience approach can increase students' understanding in learning science concepts as well as being able to learn local culture.

The learning process will be easier when using effective and efficient learning media. Web -based multimedia learning can be a solution as a learning media oriented to ethnoscience studies. Web -based multimedia is supported by various features that can support students in providing understanding of the material because it can package material ranging from descriptions, pictures, animated videos, and even a discussion chat forum with the teacher is available. These learning media are very easy to use for beginners, let alone used by teachers to use more varied learning media so that they are not too monotonous in explaining each subject matter. The positive impact for students will be more familiar with the application of technology used for learning. Practice questions packaged in the form of educational games can increase students' interest in learning and are equipped with a virtual laboratory website page to prove the type of solution that can conduct electricity.

Several studies that support the use of interactive media are the research of Handayani et al. (2021) that 92% of students actively participate in virtual learning LMS using google classroom so as to improve communication skills. The research from Muslimah & Fauziah (2021) explained that the use of Moodle -based e-learning media can improve student learning outcomes with the n-gain test of 0.70. Another study, namely by Firdaus & Hamdu (2020) who explained that in his research, developing multimedia mobile learning applications with a STEM approach could provide benefits to teachers in order to provide a real picture of learning. The results of this study indicate that the use of interactive learning media has a good response to students. Based on the description above, the development of interactive learning media for natural science subjects would be better to use web -based multimedia learning related to the material which is quite abstract seen by students. Teachers also easier to present learning materials that are initiated by basic knowledge of multimedia learning. Based on the explanation of the problems and relevant research, this research will develop ethnoscience-oriented multimedia learning on the conductivity of junior high schools to student responses. The learning media developed will present material related to ethnoscience, namely salt, and focus on conductivity material (chemistry). Conductivity is a measure to determine how strongly a solution can conduct electric current (Kanza et al., 2020). Students will get to know and learn more about science related to chemistry by linking everyday knowledge to salt making. This research is expected to obtain a study of salt ethnoscience, data analysis of student needs and student responses to the developed multimedia learning.

METHOD

This research is development research on the results of an ethnoscience study using the ADDIE model. The ADDIE model is an instructional design flow that can assist education in developing a learning system based on student needs to achieve learning goals (Yu et al., 2021). ADDIE is a process that functions as a working guide for complex situations, so it is very appropriate to be used in developing learning media and other learning resources (Branch, 2009). The ADDIE model is structured based on a structured sequence of activities so that it attempts to solve learning problems (Irwanti & Zetriuslita, 2021). The method used is descriptive qualitative. The ADDIE model used in this study includes 5 stages, namely:

a. Analyze

   The data analysis stage is carried out by analyzing the existing problems. This research requires an instrument in the process of analyzing, namely in the form of observation sheets and interviews with salt farmers. The results of the analysis are then reconstructed in the concept of an ethnoscience study which is then continued by conducting a literature study. There are 2 stages, namely performance analysis to clarify solutions and student needs to identify relevant topics and learning media.

b. Design
The design stage is carried out after the analysis stage is completed. The design stage is the process of stages in determining the material as a learning medium which will then be made a storyboard to facilitate the process of making multimedia learning.
c. Development
This development stage is the process of making multimedia learning in the form of a web that is oriented towards ethnoscience studies.
d. Implementation
The results of the development of multimedia learning were tested on students in small groups (limited trials).
e. Evaluation
The evaluation stage is the final stage to analyze the results of the multimedia learning development that has been developed and tested.

This research will reconstruct the community's original science with scientific science which will then develop multimedia learning science for junior high school conductivity materials. This research was conducted on a salt pond, precisely in Maneron Village, Sepulu District, Bangkalan Regency to study ethnoscience and at SMP Negeri 2 Kamal Bangkalan. The population in this study were seventh-grade, junior high school students, using a trial sample of 10 seventh-grade students. The sampling technique used is probability sampling, namely random sampling. Data collection techniques using interviews, questionnaires, and documentation. The student needs analysis questionnaire and student response questionnaires used a Likert scale of 5 with the following criteria.

Table 1. Likert Scale

Score	Category
5	Strongly agree
4	Agree
3	Disagree
2	Don't agree
1	Strongly Disagree

As for knowing the student's response to *multimedia learning* can be known through the results of the calculation of the acquisition score divided by the maximum score. The result of the response calculation is in the form of percentage data.

$$PS = \frac{S}{T}\ x\ 100\% \qquad (1)$$

(Adapted by Humaidi et al., 2022)

Description :
PS = Score Percentage
S = Score Earned
T = Score Total

Table 2. Criteria for the Percentage of Student Responses to Multimedia Learning

Response (%)	Response Category
81 - 100	Very Positive
61 - 80	Positive
41 - 60	Enough
21 - 40	Negative
0 - 20	Very Negative

RESULT AND DISCUSSION

Based on the results of interviews with salt farmers, information related to the process of making salt in salt ponds was obtained using traditional methods or methods. The process of making salt carried out by salt farmers utilizes pre-existing knowledge. The original knowledge of the community that alludes to facts in the community that comes from beliefs from generation to generation is part of ethnoscience (Pertiwi

et al., 2021). Ethnoscience is a system of knowledge about nature that is owned by certain indigenous cultures. This knowledge can cover aspects of ecology as well as the reciprocal relationship between humans and nature (Zidny & Eilks, 2022). Ethnoscience can be interpreted as an interdisciplinary science that combines humans with cultural anthropology with science education, so that it can be obtained by studying local wisdom contained in the ethnicity or culture of a community (Dewi et al., 2021). The results of the reconstruction of indigenous knowledge to scientific knowledge are as follows.

Table 3. Results of the Reconstruction of Indigenous Knowledge to Scientific Knowledge

Aspect of Study Topic	Question	*Indigenous knowledge*	*Scientific knowledge*	Note.
Salt in general	a. What do you know about salt?	Salt is one of the ingredients for cooking	Salt is an electrolyte that dissociates into ions when dissolved in water. [1] Salt is an ionic compound that includes positive ions (cations) as well as negative ions (anions) that form neutral compounds (no charge). [2] Salt dissolved in water makes it possible to assemble a 3 V Li-ion battery. [3] Salt hydrolysis is a reaction between anions and cations of a salt with water. [4] Sodium chloride (NaCl) which is often referred to as table salt is one of the chemicals that is widely used for various needs. [5] Science concept: compound, ion, solution	Darmiyanti, et al. (2017) Ulfah & Safitri, (2021) Dubouis, et al. (2018) Jumaeri, et al. (2018) Suhita. (2021)
	b. What are the functions of salt in daily life?	Food flavoring and as a natural food preservative	Salt is hygroscopic which can absorb water with a density level of 0.8-0.9 with a melting point at a temperature level of 801°C. [1] Food additives or preservatives are used to prevent or slow down damage to food and beverages that can occur chemically or microbiologically. [2] Salt as a flavoring with artificial spices are two things that are relevant in the cooking process, so that it can make food more liked by many people. [3] Science concepts: elements, compounds, additives	Redjeki, et al. (2020) Amir, et al. (2021) Arevalo, et al. (2021)
Salt-making tools and materials	a. What tools are used in the salt making process?	There are carts for transportation, there are shovels, there are windmills for irrigation, as well as other tools that are still manual	A simple machine consists of levers, inclined planes, wheels, and pulleys. Examples of levers include wheelbarrows, scissors, shovels and pliers. [1] Wind energy is one of the most important sources of renewable energy. [2] Science concept: simple plane	Indrayani. (2018) Marugan, et al. (2018)
	b. What are the raw materials for making salt?	Only sea water	One way of making salt can be done by evaporation of sea water with the help of sunlight. [1] Sodium chloride (NaCl) is easily obtained by evaporation of seawater. [2] Science concept: heat transfer	Mu'min, et al. (2021) Jumaeri, et al. (2018)
Salt making process	a. What energy source is most needed in the manufacture of salt?	Sunlight	Sunlight (radiation) is a radiant energy that comes from thermonuclear processes that occur in the Sun. The forms of energy from sunlight are in the form of light and electromagnetic waves. [1] Electromagnetic waves from the sun produce free electrons in the upper atmosphere of the hemisphere during the day. [2] Science concept: heat transfer, electromagnetic	Gunawan, (2019) Karasawa, (2021)
	b. Why do salt crystals form?	Because the old water is left alone	Crystallization is a purification process and the formation of solid particles that will be produced through homogeneous stages. [1]	Khairunisa, et al. (2019)

Aspect of Study Topic	Question	*Indigenous knowledge*	*Scientific knowledge*	Note.
		and becomes salt crystals	Salt crystallization is the result of the accumulation of salt in the rock. Dissolved salt usually comes from the environment, such as sea salt spray and capillaries rising from the soil. [2] Science concept: crystallization	Galanaki, et al. (2022)
The time required for the salt-making process	a. How long does it take to crystallize until harvest time?	Approximately 20 days depending on the weather.	Making salt in the traditional way using seawater evaporation technology, it takes 20 days per salt harvest. In contrast to using the insulated madurasse method which takes 12 days. [1] Over the last 15 years, the traditional salt-making activity has decreased substantially so that it is now only bartered or sold in limited quantities. [2] Scientific concepts: crystallization, heat transfer	Pranoto, et al. (2020) Yankowski, (2019)
	b. How to measure the conductivity of a salt solution? do you use tools?	Never measured, because after harvesting the salt is immediately sold	Conductivity is the ability to conduct electricity. The more ions in a solution, the greater the conductivity value. [1] Electrical conductivity is very sensitive to the composition and temperature of volcanic rocks. [2] Science concept: conductivity	Retnaningdyah, (2019) Ahmed, et al. (2018)

The table of the results of the reconstruction of the original science of the community to scientific science has been known to be related to the concept of science. The relationship between the process of making salt and the basic competencies of science in junior high school curriculum 2013 is as follows.

Table 4. The Relationship Between the Process of Making Salt and the Basic Competence of Science in Junior High School Curriculum 2013

Basic competencies		Science Concepts in Salt Making Process
7th grade		
3.3	Explain the concept of mixtures and single substances (elements and compounds), physical and chemical properties, physical and chemical changes in everyday life.	Salt can be formed from a mixture of acid and base reactions.
4.3	Presenting the results of investigations or works on the properties of solutions, physical and chemical changes, or the separation of mixtures.	The process of making salt will undergo crystallization, namely the purification process and will form a solid in the form of particles. The process of making salt by evaporation. The salt solution contains ions that can conduct electric current (conductivity). Salt is hygroscopic
3.4	Analyzing the concepts of temperature, expansion, heat, heat transfer, and their application in everyday life, including the mechanism for maintaining a stable body temperature in humans and animals.	The process of making salt prioritizes sunlight so that there will be radiation heat transfer to help the evaporation process.
4.4	Conduct experiments to investigate the effect of heat on the temperature and shape of objects as well as heat transfer.	
8th grades		
3.3	Explain the concept of work, simple machines, and their application in daily life, including the work of muscles in the human skeletal structure.	The tools used in the process of making salt use wheelbarrows, shovels, and so on which are a form of application in everyday life related to simple aircraft materials.
3.4	Presenting the results of an investigation or problem-solving about the benefits of using simple machines in everyday life.	
3.6	Explain the various additives in food and beverages, addictive substances, and their impact on health.	Salt can be used as a food preservative because it can remove water content in food so that it can inhibit microbial growth.
4.6	Write a paper on the impact of the abuse of additives and addictive substances on health.	

Basic competencies		Science Concepts in Salt Making Process
Grade 9		
3.5	Applying the concept of electrical circuits, energy and electrical power, sources of electrical energy in daily life including alternative sources of electrical energy, as well as various efforts to save electrical energy.	The process of making salt is still using windmills to add irrigation. Windmills can move the flow of water because there is a change in energy from wind energy into motion energy.
4.5	Presenting the results of the design and measurement of various electrical circuits.	
3.6	Applying the concept of magnetism, electromagnetic induction, and the use of magnetic fields in daily life including the movement/navigation of animals to find food and migration.	The process of making salt requires sunlight energy. Sunlight energy in the IPA concept can be in the form of rays and electromagnetic waves.
4.6	Make simple works that utilize the principle of electromagnetic and/or electromagnetic induction.	

Based on the results of the interview, the salt pond is only used for making salt and has never been used as an alternative energy source. Salt contains electrons that can conduct electric current, thus researchers develop multimedia learning using electrical conductivity materials. This can increase students' knowledge that the salt solution in salt ponds can also be used as alternative energy. Conductivity is a measure of how strongly a solution can conduct electric current, therefore conductivity is also called electrical conductivity (Kanza et al., 2020). The conductivity material is found at the junior high school level, namely in Basic Competence 3.3 class VII. The results of the analysis of student needs can assist in identifying relevant topics and learning media. The results of the analysis of student needs with a total of 28 students produce table 5 data.

Table 5. Results of Student Needs Analysis

Aspect	Results
Learning Media	91.43% of students understand more about learning science when using learning media
	89.29% of students prefer learning media that can be used anytime and anywhere
Learning media support facilities	89.29% of students have *an android smartphone*
	66.43% of students prefer reading science material through *smartphones rather* than through books
	80.71% of students use the internet more often in completing assignments.
Science learning materials	84.63% of students find it easier to learn science when it is associated with examples in everyday life
	83.57% of students prefer to learn science which has a connection between scientific science and indigenous science

The results of the analysis of student needs indicate that students are happier and understand science material when using learning media by linking the material in everyday life. More students access the internet network in completing school assignments. It also shows that 89.29% of students have an android smartphone. In accordance with research conducted by Rumengan & Talakua (2020) that the use of learning media in the form of mobile learning based on an Android smartphone can make students more interested in learning. Students can more easily access learning materials and can get information from anywhere and anytime. Based on this, this research will be continued by developing multimedia learning. The multimedia learning developed is as shown in Figure 1.

Figure 1. Multimedia Learning

The trial was limited to 10 students, so the data obtained for assessing student responses to *multimedia learning* which can be seen through Table 6.

Table 6. Assessment of Student Response Questionnaire Results

Aspect	Average Score (%)	Information
Appearance	97.33	Very Positive
Theory	94.25	Very Positive
Average Score	95.79	Very Positive

The assessment of student responses consisting of the appearance and material aspects obtained an average score of 95.79% which was included in the very positive category. Based on the display aspect, the percentage is 97.33% with a very positive category. Multimedia learning equipped with learning videos can make students more interested in participating in learning. The use of learning media can help students improve understanding of the material in the learning process (Dadi et al., 2019). According to the presentation of Jundu et al. (2020) that learning videos have audio and visual elements that allow students to see real action regarding the presentation of the material contained in the video so as to increase student learning motivation. Assessment of student responses to ethnoscience-oriented multimedia learning on the conductivity material, namely the material aspect obtained a percentage of 94.25% and was included in the very positive category. Assessment on the material aspect is about the ease of understanding the material. The existence of learning videos presented in learning media can assist teachers in delivering science material because it is more practical so that it can trigger students' understanding to more easily understand the concepts of science material (Erfan & Turrahmi, 2018).

The results of the acquisition of the percentage of student responses, namely in terms of appearance and material aspects, it can be seen that the multimedia learning used is very interesting and the material is easy to understand for students. Based on table 6, it can be depicted a diagram of the percentage of student responses in Figure 2.

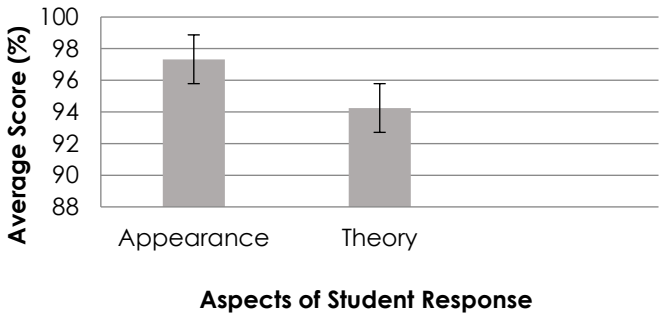

Figure 2. Bar Chart of *Multimedia Learning* Student Response Percentage

Multimedia learning developed is the result of the reconstruction of one of the scientific concepts related to the process of making salt. This multimedia learning can be accessed using an Android smartphone both online and offline. The material presented in multimedia learning includes the notion of electrical conductivity, salt solution, various solutions based on their conductivity, as well as factors that affect electrical conductivity. Teachers can also find out the cognitive development of students after doing practice questions. Therefore, this multimedia learning can be used anytime and anywhere by students. The results of this study are also relevant to research conducted by Hurst, (2018) which shows that the percentage of student responses by 43% of students strongly agrees that they feel more involved with using learning media in the form of snapchat related to chemistry. According to research conducted by Mufidah & Habibi, (2022) regarding web-based learning media, it showed that the student response test in small groups obtained a percentage of 88% with a very decent category.

CONCLUSION

Based on the results of the research that has been carried out, it can be concluded that the process of making salt, which is traditionally carried out using the hereditary method of the salt farming family, is related to the concept of scientific science. The concept of the original science of society can be

constructed into scientific science as a form of student learning resources. The ethnoscience-oriented learning resource in this research is by developing multimedia learning on the conductivity material of SMP. The results of the assessment of student responses to multimedia learning on the display aspect were 97.33% and the material aspect 94.25% which was included in the very positive category

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