Original Article

Reconstruction of Indigenous Science of Tegal's unique Moci and Tofu Aci Culture as a Source of Learning Science, Data Literacy and Technology for Students

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Abstract

Indonesia is a country that has a variety of cultures, foods, and crafts, including the culture of moci and tofu aci in Tegal. The moci tradition of drinking tea using a clay vessel and fulfilling food needs from the basic ingredients of starch and tofu will provide added value when it becomes a product of processed raw materials in the form of aci tofu. This research is educational research with an ethno-science approach, meaning that it is based on the local wisdom of the local community. This study aims to reconstruct knowledge from a cultural or societal perspective in meeting food needs which will later become knowledge with scientific explanations using aspects of data literacy and technology literacy. Investigative data were obtained through interviews, and direct observation at the location of the investigation regarding local wisdom, manufacturing methods, cooking techniques, and product marketing. Data analysis was carried out through the stages of data collection, data reduction, display, and verification. The results of this study are expected to provide scientific explanations about the method of making, cooking techniques, and product marketing in Tegal's typical moci and tofu aci culture with the local wisdom of the community so that they can be used as a source of learning science. and improve students' data literacy and technology literacy.

Keywords: Reconstruction scientific explanation, moci culture, tofu aci processing, data literacy, technology literacy.

Introduction

The science education paradigm that pays attention to the integration of local culture into science learning as a national identity and local cultural customs as a vehicle for learning science is being developed in several studies [1]. Learning with ethno-science is based on the recognition of community culture as a fundamental part of education as an expression and communication of an idea and the development of science [2]. Learning science should be able to make students understand more about what they don't know about nature so that learning science is not just about understanding theories but understanding natural science associated with local excellence in the local area is also important to understand [3, 4].

Science learning in schools and tertiary institutions pays little attention to local advantages in society, due to the limitations of educators in linking concepts, processes, and contexts, so students' understanding of natural phenomena becomes meaningless [5, 6]. Science education describes more on the development of science and technology by reflecting on the pattern of science education in western countries. Education is considered less than optimal in instilling noble values and culture [7]. The Indonesian education situation in the last 35 years has not fostered awareness of values and formalism.

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Harmonized education produces students who can be sensitive to the surrounding environmental conditions, and can understand scientific concepts when related to the environment around the community. The values adhered to by indigenous people who are full of local wisdom values (local genius) are ignored in learning, therefore learning science becomes dry and less meaningful [8, 9]. This condition needs serious attention from policymakers and practitioners of science education in the regions [10]. The solution to preventing the marginalization of local excellence is to apply science-based learning to local excellence [11].

Local excellence that develops in the community is integrated with the curriculum so that it can produce contextual learning [12]. Contextual learning emphasizes the full involvement of students to be able to find the material being studied and relate it to real-life situations to encourage students to apply it in life [13]. Remembering that culture is a reflection of people's lives in the form of belief in science that is trial and error, such as the findings of trial and error. Contextual learning itself is learning that interacts directly with learning objects. The object of learning science itself is nature and its phenomena. Contextual learning is a learning concept that emphasizes the interest between learning material and the real world so that students can connect and apply the competencies of learning outcomes in everyday life [14].

Local excellence education can involve students to be actively involved individually in the process of building their mentality from the information they obtain [15, 16]. Student-centered teaching is a teaching and learning process based on the needs and interests of students, teaching can be broadly developed and implemented at all levels of education, often even equipped with learning resources to overcome conventional obstacles. Local excellence itself can be in the form of agricultural products, artistic creations, traditions, or culture which are advantages in an area [17]. One of the local advantages of the Tegal district is the moci culture and food in the form of tofu aci typical of Tegal.

Typical food is generally in the form of traditional drinks and food which exist only in tourist destinations [18]. Tegal Regency has many special drinks and foods that can be eaten by tourists who will visit Tegal Regency [19]. Tofu aci is one of Tegal's specialties which has a savory taste and has a rectangular shape with the tofu square being split into two so that it forms 2 right triangles. and other spices [20].

Each region has a different tradition of drinking tea. One example is the tradition of drinking tea typical of Tegal which is named Moci. the acronym for the word drink (tea) and poci which means a place to brew tea made of clay. Moci's activity is defined as the activity of drinking tea using pottery pots typical of Tegal[21]. This moci is also synonymous with "Wasgitel" which stands for fragrant, hot, bitter, sweet, and condensed (thick) [22]

Along with advances in technology and information in this era of globalization, world cultural relations and linkages are getting higher [23]. Globalization and technology have shifted the original local cultural values of Indonesia. In contrast to foreign cultural values that are so rapidly developing in people's lives [24]. The existence of globalization has shifted the original local cultural values of Indonesia. Foreign cultural values that are developing so rapidly in people's lives have a broad impact on the environmental balance. Moreover, there is a phenomenon of students or female students who increasingly believe that scientific concepts are more important through the data obtained and the use of technology, are more needed, and as if they are not related to the culture of the local community [25]. The role of technology literacy and data literacy here is important to provide an understanding of the importance of indigenous Indonesian local cultural values.

Technology literacy and data literacy are part of new literacy. The transition from old literacy to new literacy is needed to meet the times in the 21st century so that students achieve success in school and life [26], [27]. In addition, new literacy skills in their development are needed for students to improve and develop their abilities in the form of knowledge and concepts that can support their lives [28]. so, new literacy is needed to face the current era. Data literacy is a technique, skill, and knowledge needed to explain information, and to find, evaluate, synthesize, present and/or communicate information according to their needs [29],[30],[31]. Data literacy is the ability to find, interpret, and use data in learning [32]. while technological literacy is engineering and technology that is part of educational goals [33]. So, technological literacy here can manage, use, understand and assess the right technology to be used.

The application of this data literacy in Indonesia needs to be developed in education [34]. Through good data literacy skills, students can make the right decisions [35],[36].respond wisely to the situation [37]. Data literacy supports students during practicum in determining the purpose of using data, finding sources of accurate data or information, processing data appropriately, and concluding information based on data [38],[39],[40],[41].

Understanding students' data literacy can influence the learning process [40]. Technological literacy has an important dimension of ability, which emphasizes the ability to manage, use, understand and assess the right technology to be used [42].

Indonesia has also begun to globalize public science as a grounded theory research as well as building new theories as a source of learning conducted by [43], who studied Ethno-science in the formation of scientific knowledge for the context of chemistry education [44]. On the one hand, most of the teaching and learning processes are still dominant in the form of memorization and are carried out in the classroom, so memorizing concepts is emphasized rather than stimulating students' curiosity in teaching and learning in the laboratory. Students tend to accept the concept of

"end" and are encouraged to believe fully in what is being taught.

They are not experienced with the proving process of how to get the concept. Thus, students are not well trained to solve 'why' questions. Students are rarely asked to evaluate why a process occurs. Opportunities to convey creative ideas or designs to solve problems are also rarely given in the teaching and learning process [45]. Therefore, to arouse students' curiosity and ideas in science learning, a reference is needed regarding the reconstruction of original scientific knowledge into scientific knowledge to build grounded theory and enrich scientific knowledge [46]. They stated that knowledge of community knowledge based on local culture and local wisdom about unique things had not been widely studied, and had not even been used as a source of learning in science learning [47].

Based on the results of the interviews, students who were interviewed during the research also stated that teachers rarely/never make connections between the science concepts being taught (scientific knowledge) and traditional culture. So far, science learning by teachers/lecturers in the classroom seems to have nothing to do with what is encountered and applied at home/outside the classroom [48]. Most of the students who live in Tegal do not know the local culture. Local knowledge of community knowledge related to moci culture and Tegal specialties, one of which is the production of tofu aci. Tofu aci has become an "icon" of Tegal culture in Indonesian culinary tourism. Tofu aci is liked by both adults and children.

Regarding the reconstruction of original scientific knowledge into scientific knowledge to build grounded theory and enrichment of scientific knowledge, in this study, the problems studied were (a) finding the types of research attributes on community and local indigenous science knowledge. The wisdom that can be found in Tegal contains scientific knowledge, (b) How to reconstruct scientific knowledge as scientific knowledge through exploration, verification, transformation, assimilation, accommodation, and conceptualization of original scientific knowledge and local wisdom, (c) formulating scientific knowledge based on indigenous knowledge and local wisdom in science learning

a. moci culture

in tertiary institutions, (d) providing an understanding of data literacy and technology literacy in moci culture and Tegal's typical tofu aci food.

Practically, the results of this study can be useful for (a) science teacher candidate students regarding the more contextual local culture-based science learning model; so that the results of developing these learning resources can enrich scientific insights that are oriented towards ethno-science, as well as increase the creativity and motivation of prospective science teachers (b) mentors for courses on learning strategies and teaching planning, namely as a source of inspiration and creativity for efforts to improve the quality and effectiveness of science learning, (c) Science students gain experience regarding character learning models based on local wisdom in Tegal and an understanding of data literacy and technology literacy

Method

This research is qualitative descriptive research with a case study design. The investigation was carried out at the locations of the tea and tofu producers in Tegal Regency which still exist, namely in Ujungrusi Village, Adiwerna District, and Dukuh Tengah Village, Bojong District. The research subjects were the surrounding community who were the actors in the production of tea, antor crackers, and tofu aci in Tegal Regency consisting of 6 (six) people, namely 3 tea producers and 3 aci tofu producers. Data collection was carried out through interviews, field observations, and documentation. Data were analyzed with the stages of data collection, data reduction, data display, and verification. Checking the validity of the data using triangulation techniques.

Result and Discussion

Research Findings

The relationship between indigenous science and moci culture, making crackers and tofu typical of Tegal with scientific science and data literacy and technology literacy

No.	Topic	STEM Aspects	of Original Science New	Types of Literacy New	Literacy Aspects of	Scientific Science
1.	What is known about the moci fragrant, hot, sweet, thick tradition and how to obtain the information	Science	Respondents answered the moci fragrant, hot, sweet, thick tradition was drinking tea using a clay vessel. The taste of the tea is fragrant, astringent, sweet, and thick. Drinking tea using this clay vessel keeps the tea hot longer.	Data literacy	Collecting data	Wasgitel is obtained from the amount of tea put in a large number of clay containers which is not the same as the presentation of tea in general. So that the impression is fragrant, astringent, sweet, and thick.

			Information can be obtained from parents, friends, and relatives			Clay cups retain heat longer. Because clay is a good insulator that keeps the tea temperature stable [49].
2.	If there are 3 cups filled with hot water, warm water, and cold water, fill them with sugar. Which of these three cups gets sweet quickly?	Science	Respondents answered a cup filled with hot water filled with easily soluble granulated sugar	Data literacy	Analyzing data	several factors affect the solubility of a substance, one of which is temperature. Heating the solvent (hot water) can accelerate the dissolution of the solute (granulated sugar). Solvents with higher temperatures will dissolve the solute faster than solvents with lower temperatures. This causes the solute (granulated sugar) to dissolve more easily at high temperatures [50].
3.	The glass that is often used when moci is a glass made of clay. When compared to ceramic cups and plastic cups. when serving which tea lasts longer?	Science	Respondents answered ceramic cups because they are thicker than plastic cups. So the heat lasts longer.	Data literacy	Analyzing data	When hot water is poured into a ceramic cup and a clay cup in equal amounts. The item that will cool the water the longest in the same amount of time is a plastic cup. Plastic cups are insulators, the worst at conducting heat so heat is wasted only through contact with air. There is no heat loss by conduction. So the water will cool the longest compared to all containers. Clay cups retain heat longer because they are good insulators that keep the tea temperature stable compared to ceramic cups [51].
4.	The process of making tea from picking to packaging?	Technology	Respondents answered that the first process is that the tea leaves are first steamed, then ground using a rattan mat. After that, it is dried in the hot sun and then roasted using a jug until dry.	Technology literacy	Managing technology	The process of steaming tea leaves is used to wither the tea leaves and soften them when they are ground on a rattan mat. The process of evaporating water so that the tea leaves dry is helped by solar radiation when it is dried in the sun and when it is roasted in a heated jug.

5.	What can the rest of the tea be used for?	Technology	answered that the remaining tea was thrown away and some answered that it	Technology literacy	Managing technology	was. brewed, flavonoids, caffeine, tannins, saponins, protein, fat, crude fiber, and minerals. Most of these compounds are antioxidant, antibacterial, anti-mutagenic, and anti-inflammatory which affects improving the health of those who consume them. Some of the benefits of tea waste are for making compost, preventing weeds, and preventing fungus and there are several other benefits [52].
6.	How to make the clay pot heat longer?	Engineering	Respondents answered that they could be wrapped in cloth or plastic containers made of clay so that they would retain heat inside.	Technology literacy	Integrating technology	If inside a container made of clay it is called a system and outside a container made of clay is called the environment. plastic or cloth material that wraps the clay container keeps no or little heat from escaping from the system to the environment or is often referred to as an isothermal process [53].
7.	The Moci wasgitel culture often uses rock sugar mixed with tea and hot water compared to granulated sugar mixed with tea and hot water. Which use of this sugar is sweet quickly?	Engineering and Mathematics	Respondents answered using granulated sugar mixed with tea and hot water because it dissolves easily compared to using rock sugar mixed with tea and hot water	Technology literacy	Integrating technology	Small-size solutes (granulated sugar) will dissolve more easily than large solutes/ lumps (rock sugar) when mixed in a high-temperature solvent (hot water) [50].
8.	How long are the tea leaves exposed to the hot sun?	Mathematics	or gribik from woven bamboo which is about 2 meters x 1 meter in area compared to the smaller size	Technology literacy	Using technology	. Every object can emit and absorb heat radiation, the amount of which depends on the temperature of the object and the color of the object. The dense color of dark tea leaves causes it to absorb heat more easily than light colors. The inlay or gribik from woven bamboo is wider than using tampah which is smaller in size. The larger the surface area of an object, the greater the heat radiated into its environment [54].

b. Typical Tegal Tofu Products

No.	Topic	Aspects of STEM	Original Science	Types of New Literacy New	Literacy Aspects of	Scientific Science
1.	What is known about the typical Tegal food called tofu aci and how to obtain the information	Science	Respondents answered that the typical Tegal tofu food comes from yellow tofu and starch attached to he asked. When fried, the aci flour will stick to the yellow tofu. Information can be obtained from parents, friends, relatives, and the internet.	Data literacy	Collects data	. Tofu that has been affixed with starch or aci flour sticks tightly when fried. This is following the research of Cristya Anggie Rosally, et al (2020) who stated that at high temperatures starch is strong, flexible and stable [55].
2.	Why is it that when frying tofu aci, the cooking oil in the pan must be hot first?	Science	Respondent answered that the heat is even, the cooking is faster and the starch is stretchy	Data literacy	Analyzing data	Technically frying is an activity to remove the water content of the fried ingredients (tofu aci) into a substance whose temperature is higher than the boiling point of water and takes place quickly. The heat of cooking oil when boiling generally has a temperature of 300 degrees to 400 degrees Celsius. while the maximum water temperature is 100 degrees Celsius, so instantly the water molecules contained in the fried ingredients (tofu aci) turn hot. This reaction is called heat transfer by convection (transfer of heat through a conducting substance accompanied by the transfer of parts of the substance). Then, the molecules in these foods transfer heat to each other to the food. This reaction is called heat transfer by conduction (transfer of heat through a conducting substance without being accompanied by a transfer of part of the substance). [56].
3.	What is the correct way to fry tofu so that it is evenly cooked?	Technology	Respondents answered that when frying tofu, you have to stir it often with a	Technology literacy	Using technology	When frying the purpose of stirring the tofu is so that the heat transfer by conduction in all parts of

			spoon so that it cooks evenly.			the tofu can be evenly distributed [57].
4.	How to make tofu aci that isn't hard when it's cooked	Technology	Respondents answered when making tofu dough, add water little by a little while stirring until smooth. When frying, heat the cooking oil over medium heat, don't overheat, so that the tofu is soft and cooked as desired	Technology literacy	Managing technology	When making tofu dough, use water little by little while stirring until smooth with the aim of the water molecules in the flour starch and raw tofu there are not too many water molecules in the starch and tofu which evaporate when fried. If too many water molecules evaporate, it will make the tofu dry and hard.
5.	What can the leftovers from making tofu be used for?	Technology	Respondents answered that the leftover tofu aci was thrown away and some answered that it was for animal feed and ingredients for making loose	Technology literacy	Integrating technology	Tofu industrial waste is harmful to humans, namely the liquid waste produced contains suspended and dissolved solids, will undergo physical, chemical, and biological changes which will cause a foul odor and if thrown directly into the river will cause contamination of the river. Masyhura MD, et al (2019) through research conveyed that people can use tofu waste as animal feed and gembus tempeh. The nutritional content of tofu dregs is quite high. So tofu dregs can also be used as ingredients in other products such as nuggets, tofu crackers and others [58].
6.	Why does Tegal's typical tofu have to be fried over medium heat with steady heat?	Engineering	Respondent answered that if the fire is too hot, then the starch or aci flour will be hard and even the outside of the aci flour will be burnt but the inside is not	Technology literacy	Managing technology	. This will allow the tofu to cook evenly and have a low risk of crumbling, sticking, or getting mushy. Heat transfer by conduction to all parts of the tofu is not too great which can cause it to burn
7.	Why does Tegal's typical tofu have to use starch? What are the advantages of starch used as a raw material for Tofu Aci?	Engineering	Respondents answered that using rice flour makes it hard. Banet. Not suitable for making tofu.	Technology literacy	Managing technology	The advantage of starch or aci flour is that it is sticky, especially if the temperature of the object that is attached to the starch or aci flour is higher. Tofu that has been affixed with starch or aci flour sticks tightly when fried. Kanji flour (Erita, 2021) has a lot of carbohydrates, without negative

						ingredients such as LDL cholesterol and saturated fat, so it can keep energy levels high and increase feelings of fullness thanks to its fiber content [59].
8.	What is the size of the yellow tofu used so that it expands easily when fried?	Mathematics	Respondents answered One yellow tofu divided by two.	Data literacy	Analyzing data	The size of the tofu is made half of its whole size so that the thermal conductivity value of the tofu when fried is greater so that it cooks evenly. The smaller the cross-sectional area of the material (tofu) the greater the thermal conductivity of the material (tofu) [60].
9.	How long does it take to fry the tofu aci?	Mathematics	Respondents answered about 2 to 3 minutes	Data literacy	Analyzing data	Time in frying is inversely proportional to the conductivity of the material. The longer the frying time, the smaller the conductivity of the material (tofu). With the cross-sectional area (A) approach and the temperature change (ΔT) fixed, it produces a large enough conductivity by shortening the frying time [61].

Discussion

Local wisdom owned by Indonesian people has an interesting study of science (indigenous science) and increases the love of Indonesian culture for students at school. One of the local wisdom that can be learned is the moci and tofu culture practiced by the people in Tegal Regency. Based on the results of the research, it is possible to reconstruct community science into scientific science so that the results of community science can be used as reference material in student learning activities.

The moci tradition or culture is an activity that is interpreted as an activity of drinking tea using pottery pots typical of Tegal[21]. This moci is also synonymous with "Wasgitel" which stands for fragrant, hot, bitter, sweet, and condensed (thick) [22]. This culture has scientific literacy on heat materials, heat conductors, heat transfer, solubility properties of objects, and utilization of tea waste. The selection of drinking utensils made of pottery (clay) is intended to maintain the heat of the tea water. Because clay is a good insulator according to research from [49].This means that the clay pottery used can keep the heat from the tea water so that it does not transfer by conduction to the surrounding environment. If this heat transfer occurs, the temperature of the tea water will drop (not keep the heat). People in the Moci tradition use rock sugar a lot and prefer granulated sugar. This phenomenon can be scientifically explained that rock sugar is less soluble than granulated sugar. Following the solubility properties of substances that are affected by the shape of the surface of the object and temperature. Hot temperatures make sugar dissolve faster in tea water. So that the sugar doesn't dissolve easily, rock sugar is an option. Granulated sugar with a smaller surface will dissolve quickly in hot water, this is following the material's solubility properties.

Making tea itself also applies the natural science concept, namely during the process of drying tea in the sun. The sunlight used to dry the tea is a heat transfer process we call radiation. The drying process is carried out in a place that is made wide because it speeds up the drying process. This is following the concept of heat transfer by radiation, namely the greater the surface area exposed to heat, the greater the heat received. The concept of IPA that can be reconstructed next is the tea waste utilization material that has been used. Waste in the form of tea dregs can still be used as organic fertilizer which is beneficial for plants. Tea waste still contains bioactive compounds such as polyphenols, flavonoids, caffeine, tannins, saponins, proteins, fats, crude fiber, and minerals. Most of these compounds are antioxidant, antibacterial, anti-mutagenic, and anti-inflammatory which affects improving the health of those who consume them [52].

The local wisdom that will be studied next is the making of aci tofu in the Tegal Regency area. Aci tofu has the main component that distinguishes it from other types of food, namely aci flour/starch. Starch has a lot of carbohydrates, without the negatives like LDL cholesterol and saturated fat, so it can keep energy levels up and increase satiety thanks to its fiber content [53]. Natural science concepts that can be reconstructed from making tofu include material temperature, heat transfer, and thermal conductivity. The aci tofu is fried when the oil is hot, this activity aims to completely remove the water content from the tofu due to heat transfer from the hot oil. This heat transfer is called convection heat transfer. The way to fry tofu aci is also by turning and using medium heat, this aims to make the heat transfer by conduction in the tofu parts run evenly. So that the heat will move evenly on tofu.

The results of fried tofu aci will be better and can expand well when fried tofu is cut into two parts. This allows the rate of heat transfer (thermal conductivity) to be faster. Because cutting tofu means reducing the surface area of the tofu, the smaller the surface area, the faster the time needed to fry the tofu. In addition, how to knead (mix) flour with water in small steps and then gradually, so that the dough does not have too much water content.If the content of aci is not too much then the process of heat transfer and evaporation takes place quickly and makes the aci not too hard. The rest of the tofu-making process which we often call tofu dregs can be reused as an ingredient in other products such as nuggets, tofu crackers, and others. The remaining water from tofu processing must be disposed of properly because the remaining water from tofu processing is easily decomposed if it is thrown into the river or left like that. Of course, this can pollute the environment, especially rivers.

The results of the reconstruction of community science into scientific science which is studied based on scientific literacy and technological literacy obtained in the Moci tradition and the making of tofu aci in the Tegal district, we can use as material for learning science. Developing teaching materials based on local wisdom will assist students in carrying out the learning process because the learning process based on local wisdom can improve students' cognitive learning outcomes, improve process abilities, and increase student learning activities, and critical thinking skills besides that, local wisdom-based education is also able to improve student life skills [61], [63], [64], [65]. Local wisdom that can be used in compiling teaching materials must be scientifically tested. Teaching materials on the Moci tradition and making tofu aci are expected to make students understand more about material regarding temperature, heat, heat transfer, thermal conductivity, and solubility properties of objects [66]. Students will be better able to understand the process of heat transfer (convection, conduction, radiation), the application of temperature and heat and the application of thermal conductivity in everyday life. This is because the examples given are things that have been done or are around them. In the Semester Learning Plan (RPS) for the Engineering Physics course in Mechanical Engineering Diploma 3 Study Program, the material on temperature and heat is found in Sub-CPMK-4. Analyzing and measuring temperature and heat values is presented in Semester I. The benefits of using wisdom-based science teaching materials Local learning is helping students in the learning process (understanding, applying) and connecting with facts in everyday life.

Conclusion

The reconstruction of the science of the people of Tegal Regency in the Moci tradition or culture and making tofu aci is an application of the science concept in the matter of temperature, heat, heat transfer (convection, conduction, radiation), application of thermal conductivity in everyday life. In addition, the constructed IPA concept is the solubility of substances. The results of the reconstruction of the original science of the people of the Tegal Regency can be used as teaching materials for students. In the Semester Learning Plan (RPS) for the Engineering Physics course in the Diploma 3 Mechanical Engineering Study Program, material temperature and heat are found in Sub-CPMK-4, Analyze and measure temperature and heat delivered in Semester I.

For further researchers, it is hoped that they can conduct research with new methodologies, research designs, and variables to improve the development of science in the health sector and can find out efforts to prevent and control the incidence of ARI in children.It is expected that family members who smoke are not near children and for those who use the stove to keep using the stove, and for those who use firewood, use completely dry firewood and make sure the wood burns completely.

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