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Ethnoscientific literacy in Pacu Jalur tradition: Can students connect science with their local culture?

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Abstract
Ethnoscientific literacy is related to the ability to explain a cultural context scientifically. Pacu Jalur is a long boat rowing competition that is a hereditary tradition of the Malay people who occupy the area along the Kuantan River in Riau Province, Indonesia. Pacu Jalur is most popular with the local community because involves many people in the process of making the boat, preparing for the event, and ten of thousand people watching local or national competition events. We wanted to identify the extent to which this tradition had an impact on students' ethnoscientific literacy. For this purpose, we have surveyed 480 high school students who live around the Kuantan River using an ethnoscientific literacy test. The result showed that the ethnoscientific literacy of students living in this area is unsatifactory and no significant differences identified between male and female students. We have also identified a positive impact of the atmosphere event on students' ethnoscientific literacy.

Keywords: ethnoscientific literacy, Pacu Jalur tradition, the long boat rowing competition

INTRODUCTION

The integration of local community cultural traditions into the teaching of science has long been studied and is now starting to be re-examined. Fasasi (2017) has found that ethnoscience has an impact on improving students' abilities in science in Nigeria. These results are in line with the study of Morales (2017) where physics activities in the folk game, *Laro-ng-Lahi* (indigenous Filipino game) show significant changes in improving students' conceptual understanding. According to Parsons and Carlone (2013), culture is a context- and time-dependent phenomenon that exists in various local, global, micro, macro, historical, and contemporary fields that allow us to derive meaning from events that occur at present as well as plan for the future. Culture unconsciously produces knowledge that has been passed down from generation to generation. Ethnoscience refers to knowledge that is part of the cultural traditions of a community that can be explained from a scientific perspective. Ethnoscience is very important to us because it can minimize the mystical or magical views of a cultural tradition.

Ethnoscience in Science Education

Ethnoscience can be defined as a tool of knowledge possessed by a society or ethnic group obtained by using certain methods and following certain procedures that are part of the traditions of a particular society, and the truth can be tested empirically (Davison & Miller, 1998; George, 1991). Meanwhile, Fasasi (2019) defined the ethnoscience approach as an instructional approach that systematically accesses and assesses students' previous cultural beliefs and ideas related to the science concepts taught in school to ensure a better understanding. However, Eisenhart (2001) pointed out that, in science education, local traditional culture rarely gets attention.

Ethnoscience Studies in Indonesia

In Indonesia, ethnoscience based on local cultural traditions has widely studied in the last five years. The purpose of the studies is to integrate science and technology with a strong cultural-tradition in society so that science can be better interpreted and beneficial for students. In addition, ethnoscience in science education

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Contribution to the literature

- The excitement of celebrating cultural traditions will not have an impact on students' scientific literacy if they are not accompanied by making these traditions as a context for teaching science.
- There is no effect of gender on students' ethnoscience literacy.
- Local popular cultural traditions have great potential to build students' scientific literacy if science teachers can optimize these traditions as a learning context, otherwise, traditions are just entertainment to be enjoyed.

aims to introduce and instill students' love for the native culture of their nation. Sudarmin et al. (2017) studied more ethnoscience in famous traditional Javanese culinary arts such as gedhuk and cendhol and also connected ethnoscience with entrepreneurship in science education. Melyasari et al. (2018) developed science teaching materials oriented to motifs and *batik* cloth making. Meanwhile, Olivia et al. (2020) studied ethnoscience in traditional salt making in West Sumatra. Hikmawati et al. (2021) studied local wisdom in Lombok society, which contains elements of ethnoscience such as *Sasak Sade* village, *Bau Nyale* tradition, *Sesek* weaving, *Gendang Beleq*, and *Poteng Reket*. The ethnoscience study by Suprapto et al. (2021) focuses more on the Javanese cultural tradition, such as *Reog Ponorogo*, which contains elements of science: force and motion. In Riau, one of the provinces in Indonesia located on Sumatra Island, there is a cultural tradition of the Malays who inhabit the upstream area of the Kuantan River, namely the *Pacu Jalur* tradition. This tradition is quite famous so that becomes an annual local and national competition event. This traditional event involves many people in the preparation and tens of thousands of people in watching the event.

Pacu Jalur Tradition

Pacu Jalur is a local term from the Malays in Rantau Kuantan Riau, which refers to a rowing competition for a long boat made of a wooden tree. The length of the boat is about 25 to 27 meters with a width of one to 1.25 meters in the middle of the boat. The Jalur boat can accommodate 40 to 60 boat crew, most of whom are rowers (Hamidy, 1986). The *Pacu Jalur* tradition has existed in Rantau Kuantan since 1900 (Hamidy, 1986). At first, the people in Rantau Kuantan built boats to transport their agricultural products. Out of joy and gratitude for the abundant harvest, a boat rowing competition was created, which is held every commemorating major Islamic holidays. After the arrival of the Dutch in Rantau Kuantan, the boat race became livelier and more competed for prizes. The Jalur boat race was to commemorate the birth of the Queen of the Netherlands, Queen Wilhelmina. After Indonesia's independence, on August 17, 1945, the *Pacu Jalur* was held to enliven the commemoration of the independence day of the Republic of Indonesia (Hamidy, 1986). The Jalur boat was developed following the development of the local wisdom of the local community so that the Lintas boat and the tradition of making the Lintas boat reached its current form.

To get to the *Pacu Jalur* race, a Jalur boat goes through several stages of the manufacturing process. The construction of the boat begins with the selection and felling of timber trees for the Jalur boat. The selected timber tree is about 1.5 meters in diameter, straight, and about 35 meters long before reaching a branch. In general, this type of wood comes from the *Meranti* wood with families: *Dipterocarpaceae*, genera: *Shorea*, *Anisoptera*, and *Dryobalanops*. Among the *Meranti* woods that are mostly chosen as the wood for the Jalur boat is wood with local names: *Kuyuang* or *Kuyung* (Shorea palembanica Miq.), *Kureh* or *Kuras* (Dryobalanops aromatica Gaertn), *Tonam* or *Mersawa* (Anisoptera marginata Korth.), and *Banio* or *Barnio* (Shorea stenoptera Burck) (Hamidy, 1986; Restiawati, 2020). Some of these wood species are threatened with extinction. In cutting down trees some rituals have become a tradition of the Rantau Kuantan community, such as smoking wood trees and reciting certain spells.

After the tree is cut down, the wood is formed into a boat. When the boat is half finished, it is heated by putting the boat on a bonfire for several hours. This process begins with a traditional process and is known in the local language as the *Malayur Jalur* tradition (Hamidy, 1986; Hasbullah et al., 2016). In the process of heating the boat, many things can be explained scientifically. In bringing the boat from the forest to the village, there is a tradition called *Maelo Jalur*. *Maelo Jalur* is pulling the boat from the forest to the village using traditional technic. This tradition involves many people.

Arriving at the village, the work on the Jalur boat is carried out until the boat is finished and ready to go down to the river for the first time or known as the tradition of *Jalur Turun Mandi*. In this tradition of taking a bath, there is also a trial competition known as *Pacu Godok*. *Pacu Godok* refers to the type of food were eaten together between the boat crew and the spectators after the trial race. If the Jalur boat has been declared feasible, it is ready to take part in the *Pacu Jalur* race event, both at the district level, as well as the national level.

The number of *Jalur* boat crew is quite a lot, ranging from 40 to 60 people. The boat crew is called anak pacu in the local language. There is a division of labor for the crew of the boat. The crew who is in the bow is called

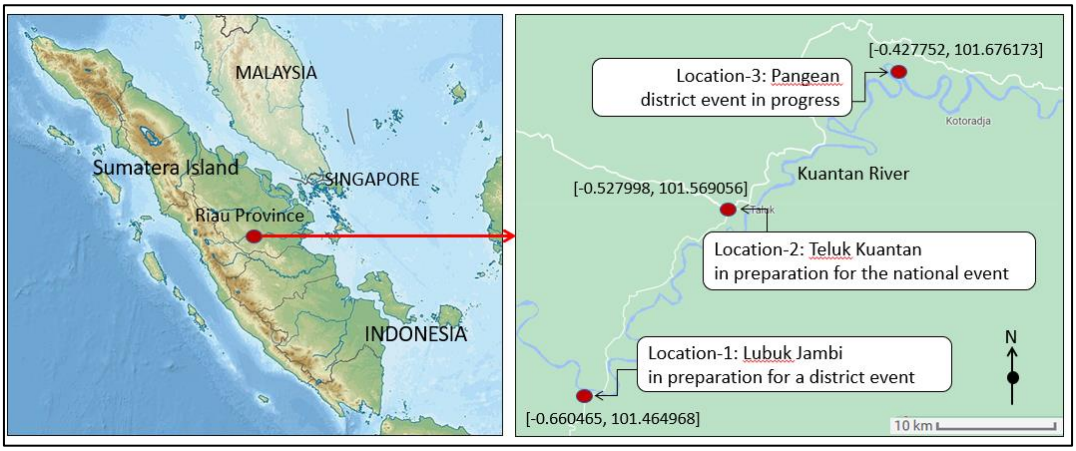

Figure 1. Locations of research (Source: Modified from Google Maps)

Tukang Tari. It is in the bow in a standing or sitting position. His job is to dance to cheer up the boat crew. The next crew is *Tukang Concang*. This crew usually consists of 4 rowers who act as rowing commandos for the others. Because the boat is quite long, then most of the boat crew are oarsmen (Hamidy, 1986). In the mid-boat position, there is a crew in charge of removing the water that enters the boat and also serving as a signal giver. This boat crew is called *Tukang Timbo*. About two oarsmen in the back also served as helmsmen, so they were called *Tukang Kemudi*. In the very rear position stands a boat crew known as *Tukang Onjai*. The *onjai* crew is in charge of applying pressure up and down so that the boat body becomes rhythmic. The cohesiveness of the boat crews will determine the victory of a *Jalur* boat.

Pacu Jalur has become even nationally held every year from June to August. The peak activity of *Pacu Jalur* was centered on the Tepian Narosa, at Teluk Kuantan. Teluk Kuantan is a small town located on the banks of the Kuantan River, which is the capital of Kuantan Singingi Regency, Riau Province, Indonesia. *Pacu Jalur* was followed by tens to hundreds of boats and watched by tens of thousands of people in the natural tribune, which stretched out on the banks for about one km, along the racetrack. Before the national event, district-level competitions were held in several districts.

The *Pacu Jalur* tradition has a lot of science and technology content that has developed within the framework of the local wisdom of the local community. Due to the deep and broad effects of *Pacu Jalur*, especially for the Malay community in the Rantau Kuantan Region, ethnoscience in *Pacu Jalur* is important to be learned in teaching science, especially in physics subjects in schools. Moreover, there has been no study of the *Pacu Jalur* tradition from the point of view of science education. Hasbullah et al. (2016), Silawati and Aslati (2014) have studied the *Pacu Jalur* tradition from magical or mystical aspects from the perspective of the Kuantan community. Meanwhile, Febra et al. (2018) studied *Pacu Jalur* from the sports science aspect.

Research Objectives

Recognizing the enormous potential of ethnoscience in the *Pacu Jalur* tradition, this tradition is seen as an interesting context for teaching science in schools. As a first step, we want to identify the impact of the *Pacu Jalur* tradition on students' ethnoscientific literacy, especially for students who live in the Kuantan River area. We define ethnoscientific literacy in this study as the ability of students to explain *Pacu Jalur* tradition scientifically. For this reason, the questions that will be answered through this research are, as follows:

1. To what extent is the ethnoscientific literacy of students living in areas where the community preserves the *Pacu Jalur* tradition?
2. Is there a gender role in *Pacu Jalur*'s ethnoscientific literacy?
3. Is there any impact on the atmosphere of the preparation and implementation of the *Pacu Jalur* event on students' ethnoscientific literacy?

METHODS

This study involved 480 high school students as respondents. They came from three high schools representing schools in the Kuantan River Area, where the community adheres to the *Pacu Jalur* tradition. The location of school-1 is in Lubuk Jambi, representing the upstream district of the Kuantan River, about 22 km from the city of Teluk Kuantan. People in this district were preparing for the *Pacu Jalur* event at their place. The location of school-2 is Teluk Kuantan, the capital of the Kuantan Singingi district in the middle of the Kuantan River, where the *Pacu Jalur* national event will be held. The people of Teluk Kuantan city were preparing for the *Pacu Jalur* national event at their place. Meanwhile, school-3 located in Pangean, representing the downstream district of the Kuantan River, which is about 30 km from Teluk Kuantan city. The community in this district were carrying out the *Pacu Jalur* event. **Figure 1** shows the research location.

Figure 2. *Pacu Jalur* competition and boat crew (a-tukang tari [a boat dancer: gives spirit to the oarsmen]; b-tukang concang [four people as oarsmen commando]; c-tukang dayung [more over 40 oarsmen]; d-tukang timbo [a crew who drains the water on the boat]; e-tukang kemudi [two people who drive and also row the boat]; & f-tukang onjai [a person who gives the rhythm to the boat]) (Source: Authors' own elaboration)

We used the *Pacu Jalur* ethnoscience literacy test to determine students' ethnoscience literacy. This instrument was compiled based on aspects of the *Pacu Jalur* tradition and aspects of scientific literacy according to PISA 2018 (OECD, 2019), namely the competence to explain natural phenomena scientifically. The instrument consisting of 25 multiple-choice questions has been validated and tested for reliability so that the KR-20 coefficient is 0.86. The research data were analyzed descriptively to obtain a profile of the ethnoscience literacy of the *Pacu Jalur* tradition from the respondents both as a whole, as well as based on *Pacu Jalur* sub-context, gender, and school location. Based on the mean score, we categorize the level of students' ability to explain this tradition scientifically into five categories. Because the scientific literacy measured in this study is the ability to scientifically explain phenomena by following PISA 2018 (OECD, 2019) with low and medium levels, we categorize the mean score of ethnoscientific literacy in this study as follows: low/poor (0-60), moderate/moderate (60-70), good (70-80), very good (80-90), and excellent (90-100). This rule is widely used by researchers, for example, Dewi et al. (2019) and Gu et al. (2019). Meanwhile, ANOVA analysis is needed to identify the effect of gender and school location on the respondent's ethnoscience literacy level.

RESULTS

To arrive at the *Pacu Jalur* race, a Jalur boat has to go through several stages. Because it applies from generation to generation, the local community makes it a tradition. The tradition starts from selecting and cutting down trees for boat purposes, building and heating the boat, pulling the boat to the village, lowering the boat into the river for the first time, to the tradition of preparing the boat for the race. The end of the *Pacu Jalur* tradition is the national *Pacu Jalur* event, which was held in Tepian Narosa, Teluk Kuantan City. Tens of thousands of spectators packed the natural stands on either side of the river along the racetrack, which is about one km. **Figure 2** shows the *Pacu Jalur* race and the boat crew involved according to *Pacu Jalur* tradition.

Under the *Pacu Jalur* tradition, in addition to the rowers and rudders, the boat crew must be equipped with *tukang tari* (dancer), *tukang concang* (rower commandos), *tukang timba* (dipper), and *tukang onjai* (person who gives the rhythm to the boat) as shown in **Figure 2**. However, for some reason, *tukang tari* and *tukang onjai* can slip so it falls into the water. Given the number of *Jalur* boats that will participate in the competition, each competition session is only followed by two Jalur boats with a knockout system.

The *Pacu Jalur* tradition contains many elements of science, especially physics that are relevant to the physics content that students have studied and are currently studying at school. For example, *tukang onjai*. "Is it just tradition or does it play a scientific role in making the boat faster in the race?", "Why do only two boats compete in one session, why not three or four?" We asked the respondents these kinds of questions, but we grouped these questions based on the sub-context of the *Pacu Jalur* tradition as shown in **Table 1**.

Through distribution to predetermined respondents, we have obtained ethnoscientific literacy data from respondents, both in general and in terms of gender and school location. The data have been analyzed descriptively and inferentially. The results we have obtained are described, as follows.

To What Extent Is the Ethnoscientific Literacy of Students?

Descriptive data analysis shows the extent to which respondents can explain the *Pacu Jalur* tradition scientifically, both as a whole, and based on the *Pacu Jalur* sub-context. The data are shown in **Table 2**.

Table 2 shows the ethnoscientific literacy of respondents based on six aspects or sub-contexts of *Pacu Jalur*. Among these six sub-contexts, the selection, logging, and towing of the boat (MMM) is higher than the others. However, this sub-context is only in a medium category. The scientific literacy in the sub-context of making and heating (MMJ) is lower than MMM, and the level of ethnoscientific literacy in this sub-context is in a low category. The same is true for the other four sub-contexts. In general, the ethnoscientific literacy of the *Pacu Jalur* tradition of the respondents is in a low category, M=40.72; SD=11.40. The results of this analysis indicate that the respondents have not been able to provide a good scientific explanation about the *Pacu Jalur*, although every year they witness, and even get involved in the preparation and competition of the *Pacu Jalur*.

Table 1. Sub-context of *Pacu Jalur* tradition and its scientific aspects

Sub-context, in local terms	Brief description according to *Pacu Jalur* tradition	Scientific aspect
Memilih, Manobang, Maelo Jalur (MMM)	Activities of choosing suitable trees, cutting down trees starting with traditional rituals, & traditional village celebration in pulling semi-finished *Jalur* boat form jungle to village.	Choose a suitable tree, predict heights, & measure diameters: -Force & torque in cutting down tree & -Friction, resultant of force.
Membuat, Melayur Jalur (MMJ)	*Finish Jalur boat construction & heat it up:* There is a tradition ritual of heating boat.	-Force & energy & -Heat transfer: Convection.
Bagian Jalur & *Cacat Jalur* (BCJ)	*Jalur boat parts & boat defects:* Parts of *Jalur* boat as a product of local wisdom, but sometimes there are some defects that occur.	-Simple machine: Lever & -Force, torque, & friction.
Jalur Turun Mandi (JTM)	*Jalur boat down to bath*: It is a tradition for people of a village to lower their new boat into river for the first time & test boat.	-Archimedes' law: Floating, mass density & -Balance of force.
Anak Pacu (AP)	*Jalur boat crew:* There are 40 to 60 boat crews who have different roles in boat as a product of local wisdom of community.	-Rigid body balance, -Moment of inertia, & -Third law of Newton, angular momentum
Pacu Jalur (PJ)	*Jalur boat race:* There are some district events before national event of *Jalur* boat race. Several rituals are carried out to release a boat to participate in competition such as prayers, mantras, & choose right time.	-Kinematics: Displacement, velocity, & acceleration, -Newton's second law, & -Bernoulli's principle.

Table 2. Results of descriptive analysis of ethnoscientific literacy

Jalur boat sub-context	Ethnoscientific literacy			Category
	n	M	SD	
MMM	480	60.00	25.47	Medium
MMJ	480	51.46	27.04	Low
BCJ	480	30.21	28.85	Low
JTM	480	35.42	20.64	Low
AP	480	38.96	24.46	Low
PJ	480	33.96	21.38	Low
Total	480	40.72	11.40	Low

Is There a Gender Role in Students' Ethnoscientific Literacy?

Pacu Jalur is very popular with all men and women, from children, teenagers, and adults to the elderly. Most of the male students are generally directly involved in *Pacu Jalur*, while the female students like to watch the race. Therefore, through this research, we want to know whether there is a difference in the ability to explain the *Pacu Jalur* (PJ) tradition scientifically between male and female students. The results of descriptive and inferential analysis by gender are presented in **Table 3**.

Table 3 shows that in general, male respondents have slightly higher ethnoscientific literacy than female respondents. However, the difference in mean scores was not statistically significant. ANOVA test has obtained $F=1.55$; $p>.05$. This states that in general there is no influence of gender on students' ability to explain the tradition scientifically.

The statistical analysis of the role of gender on ethnoscientific literacy skills for each *Pacu Jalur* sub-context is clearly shown by the graph in **Figure 3**.

The line in the graph in **Figure 3** does not represent continuous data, but we only want to show the difference in mean scores between male respondents and female respondents for each *Pacu Jalur* sub-context. **Figure 3** shows that the respondents' ethnoscientific literacy does not show the same pattern for each sub-context.

In the sub-context of selecting, felling, and pulling the *Jalur* wood to the village (MMM), male respondents had a significantly higher mean score compared to female respondents (see **Table 3**). The same thing also happened in the sub-context of making and heating the *Jalur* boat (MMJ).

Table 3. Ethnoscientific literacy by gender

Pacu Jalur sub-context	Male				Female				ANOVA	
	n	M	SD	Category	n	M	SD	Category	F	Sig.
MMM	185	63.65	25.39	Medium	295	57.71	25.29	Low	6.24	.01
MMJ	185	56.22	27.12	Low	295	48.47	25.59	Low	9.49	.00
BCJ	185	30.81	29.79	Low	295	29.83	28.29	Low	.13	.72
JTM	185	34.05	20.42	Low	295	36.27	2077	Low	1.31	.25
AP	185	36.89	23.90	Low	295	40.25	24.75	Low	2.15	.14
PJ	185	34.13	22.24	Low	295	33.85	20.86	Low	.02	.89
Total	185	41.53	11.43	Low	295	40.20	11.38	Low	1.55	.21

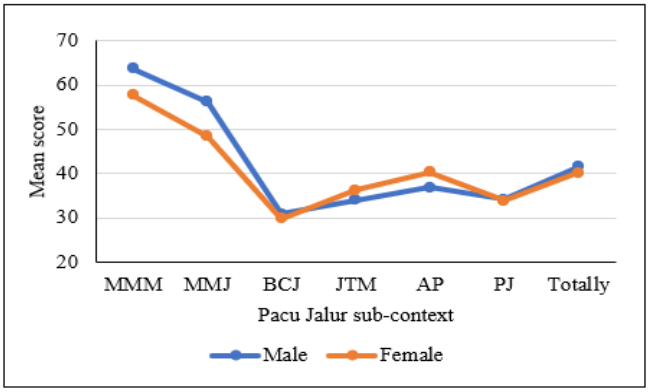

Figure 3. Gender roles in ethnoscientific literacy (Source: Authors' own elaboration)

In the MMM sub-context, we asked respondents about the physics concept of using a rope when a tree is cut down so that the tree can be directed to a certain position. We also asked about the application of the resultant force to the tradition of pulling the wood to the village (*maelo* tradition), including scientifically explaining the local wisdom of the community in reducing the friction of the wood of the path on the ground. Similar to the MMM sub-context, the MMJ sub-context relates to boat building and heating. The purpose of heating a semi-finished boat is to open or widen the respondents about the scientific reasons why boats are made hollow and why boats need to be warmed. Activities in these two sub-contexts are menial jobs dominated by men. This is the reason that male students are better than female students at explaining the MMM and MMJ sub-contexts scientifically. However, women also witness traditional rituals in both sub-contexts.

Although not significant, the ethnoscientific literacy of male respondents in the BCJ sub-context is higher than female respondents. This is not surprising because the boat crew are male so naturally, they are used to being part of the boat. In this sub-context of BCJ, we ask about the scientific principle of rowing and the weaknesses of a *Jalur* boat. Meanwhile, in the other three sub-contexts, the ethnoscientific literacy of female respondents is slightly higher than that of male respondents, but this difference is not significant.

The JTM sub-context relates to the scientific explanation of the tradition of lowering a boat for the first time on a river. In this sub-context we ask about the balance of forces, the application of Archimedes' Law when a boat floats on the surface of the water, as well as the effect of river water density on the boat's ability to float. In this sub-context, although not significant, female respondents were slightly better than male respondents in providing scientific explanations.

Almost the same thing also happened in the AP sub-context. This sub-context relates to students' ability to explain the function of each *Pacu Jalur* crew from a scientific point of view, such as a dancer (*tukang tari*) who always stretches his arms so as not to fall, an *onjai* worker who puts pressure on the boat, and the principle of rowing as the boat's rudder. In the PJ sub-context related to the physics aspect of the *Pacu Jalur* race, male and female respondents were almost equal in their ability to explain the race scientifically.

Based on the above analysis, we conclude that ethnoscientific literacy for the sub-context, which requires manual labor, male respondents have significantly higher scores than female respondents. For other sub-contexts, there is no significant effect of gender on ethnoscientific literacy. Overall, we find that gender does not have a significant effect on students' ability to provide scientific explanations for the *Pacu Jalur* tradition.

Is There Any Effect of the Pacu Jalur Event on Students' Ethnoscience?

We have also identified the effect of the preparation and implementation of the *Pacu Jalur* event on the ethnoscientific literacy of the respondents. For this reason, we have distinguished the three areas of the respondent's home school based on the distance from the area to the center of the *Pacu Jalur* festival in Teluk Kuantan city and the ongoing preparation and implementation of the *Pacu Jalur* competition as described in **Figure 1**. Data analysis related to this purpose is shown in **Table 4**.

Table 4 shows descriptively, the ethnoscentific literacy of respondents is different for the three locations. The average ethnoscientific literacy score of location-3 respondents tends to be higher than the other two locations. ANOVA test got $F=13.97$; $p<0.05$, which means that there is an influence of location on ethnoscientific literacy. This result is supported by Scheffe's post-hoc analysis, which shows that the average ethnoscentific literacy score of location-1 respondents is significantly different from that of location-2 and location-3 respondents. Meanwhile, the average ethnoscientific literacy score of location-2 respondents was not significantly different from that of location-3 respondents. Because the location of these schools, in this case, is related to the excitement of the community in preparing and carrying out the *Pacu Jalur* event, the results of the ANOVA analysis in **Table 3** above lead us to the conclusion that there is a significant effect of the *Pacu Jalur* event on students' ethnoscientific literacy.

To clarify what are the differences in students' ethnoscientific literacy based on the *Pacu Jalur* event, the data in **Table 3** is then presented in graphical form as shown in **Figure 4**.

Viewed from the *Pacu Jalur* sub-context, **Figure 4** shows that the ethnoscientific literacy of respondents in location-3 tends to be higher than in the other two locations. For the BCJ sub-context, in addition to ANOVA, Scheffe's Post-Hoc analysis showed that the

Table 4. Ethnoscience literacy based on the event of the *Pacu Jalur*

Pacu Jalur sub-context	Location-1: In preparation for the district event			Location-2: In preparation for the national event			Location-3: Event in progress			ANOVA	
	n	M	SD	n	M	SD	n	M	SD	F	Sig.
MMM	126	57.34	31.47	170	62.35	21.80	184	59.65	23.92	1.43	.24
MMJ	126	47.88	28.44	170	50.98	26.19	184	54.35	26.64	2.19	.11
BCJ	126	24.07	22.95	170	27.25	26.07	184	37.13	33.30	9.36	.00
JTM	126	36.71	22.95	170	37.94	21.10	184	32.20	18.08	3.79	.02
AP	126	32.34	23.04	170	44.56	24.55	184	38.31	24.22	9.46	.00
PJ	126	26.42	18.34	170	33.44	20.27	184	39.60	22.71	15.13	.00
Total	126	36.25	12.18	170	41.93	10.85	184	42.65	10.57	13.97	.00

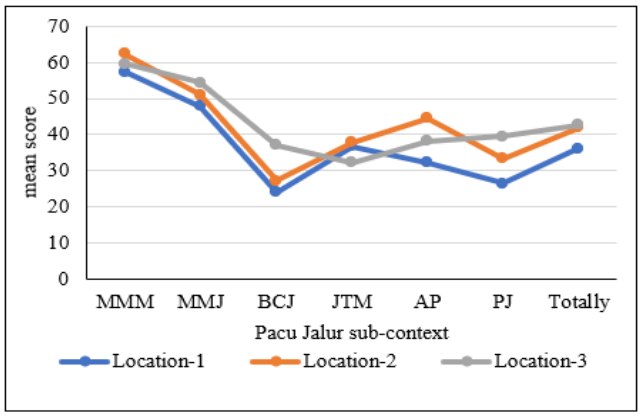

Figure 4. The effect of the *Pacu Jalur* event on students' ethnoscientific literacy (Source: Authors' own elaboration)

average ethnoscientific literacy score of location-3 respondents was higher and significantly different from location-2 and location-1 respondents. For the JTM sub-context, the average ethnoscientific literacy score of location-2 respondents is almost the same as location-1 and significantly higher than location-3 respondents.

For the AP sub-context, the average ethnoscientific literacy score of location-2 respondents was higher and significantly different from the other two locations, while the average ethnoscientific literacy score of location-1 and location-3 respondents was not significantly different. Meanwhile, for the PJ sub-context, the average ethnoscientific literacy score of location-3 respondents is higher than that of location-2 respondents and the average ethnoscientific literacy score of location-2 respondents is higher than location-1 respondents. Post-hoc Scheffe shows that the difference in the average scores of the three respondents in the three locations in this PJ sub-context is significant. This PJ sub-context relates to the race of *Pacu Jalur*. Here we ask for the force, acceleration, and shape of the motion graph of a Jalur boat, as well as Bernoulli's principle of when boats move too close together. It turns out that the ongoing event influences students' ability to scientifically explain the *Pacu Jalur* in this sub-context.

Based on the analysis above, we conclude that the atmosphere of the *Pacu Jalur* event influences students' ethnoscience literacy. Respondents residing in areas that carried out the *Pacu Jalur* event showed significantly higher literacy compared to other areas. We have also identified that respondents residing in areas preparing for a larger event (national level) showed better ethnoscientific literacy.

DISCUSSIONS

From the facts described in **Table 2**, we found that students' ethnoscience literacy in the context of the *Pacu Jalur* tradition is less than satisfactory. The ability of students to relate the knowledge learned at school with the tradition of racing lanes is still weak. Although these results are in line with various measurements that Indonesian students' scientific literacy is still relatively low (Jufrida et al., 2019; OECD, 2019; Purwani et al., 2018), but we hope that students' scientific literacy related to the *Pacu Jalur* tradition would be better. This is because the *Pacu Jalur* tradition is a hereditary cultural tradition in this region and has even become a national event. The boat path itself is owned by each village and is a matter of pride for a village in Rantau Kuantan.

In addition, students in this area have been involved in this tradition, either directly in the process of making or preparing boats for the *Pacu Jalur* race, or indirectly, as spectators and fans of the *Pacu Jalur* event. Preparation for *Pacu Jalur* events in each village ahead of national and local events generally takes several months before the competition, including boat building or repair of boats, race training, and race trials. During that time, students, as villagers, were also involved directly or indirectly. But unfortunately, it turns out that the atmosphere of traditional celebration and the involvement of students, in this case, has not been able to encourage them to explain their traditional game scientifically.

Pacu Jalur tradition is a good context for teaching science, especially physics in schools, especially to improve their scientific literacy. This is emphasized by Jenkins (1997), who has stated that scientific literacy is not context-free. In PISA, context is the main means for students to demonstrate their scientific literacy skills. In the *Pacu Jalur* tradition, scientific work starts from the process of selecting suitable trees, cutting down, and pulling the wood to the manufacturing village, to the *Pacu Jalur* competition. By the local community, the process becomes a cultural tradition that can be explained scientifically. Unfortunately, in our focus group discussions with six physics teachers in each

respondent's home school location, we found that *Pacu Jalur* was rarely used as a context for teaching physics in schools.

So far, physics teaching is only oriented to the general context written in textbooks. As a result, students find it difficult to explain the *Pacu Jalur* tradition scientifically. Ethnoscience learning makes the local wisdom of the people of an area the object of science learning (Suprapto et al., 2021). Another factor that causes the students' weak scientific literacy is the lack of understanding of science teachers on ethnoscience and scientific literacy. Rubini et al. (2017) found that the problem of students' low scientific literacy was also influenced by the weak scientific literacy of science teachers, especially in explaining phenomena scientifically.

We conclude that the ethnoscientific literacy of students in the Rantau Kuantan area is still low. Obtaining an average score, M=40.72; SD=11.40 shows that students' ability to explain their cultural traditions is still low or poor, according to Gu et al. (2019). This achievement is unsatisfactory, considering that the competency tested is at the level of scientifically explaining phenomena. This is still far from the two scientific literacy competencies according to PISA 2018, namely evaluating and designing scientific inquiry and interpreting data and scientific evidence (OECD, 2019). Therefore, students' ethnoscientific literacy in this context is at least at a score of 70.00 in the good category

We strongly suspect that the weak ethnoscientific literacy of these students is due to the lack of emphasis on science learning in schools on the scientific aspects of the *Pacu Jalur* tradition itself. This is in line with the opinion of Suprapto et al. (2021), which states that ethnoscience has received less attention from science education experts and science teachers in Indonesia. Thus, students are less concerned with aspects of science from the process of making a boat to the *Pacu Jalur* event. Deep involvement of students in the *Pacu Jalur* tradition or just as spectators has little impact on students' scientific literacy. Students view the *Pacu Jalur* tradition as merely a cultural tradition event without trying to relate it to the science learned at school. In this situation, the role of the science teacher is needed to make connections between science and the context of everyday life that students experience or what they observe. Without this connection, the science that students have learn seems to only be science or physics history written in textbooks.

Giving optimal emphasis on context is very important in teaching science in schools. Context makes the science concepts learned more meaningful to students. If students can explain the context scientifically, it will make students feel the benefits of learning science. Learning that is not concerned with contexts that are close to student life or popular contexts, will be difficult to improve students' scientific literacy.

Viewed from the gender aspect, the results of the data analysis as shown in **Table 3** show that overall, gender does not affect students' ability to explain the scientific aspects of the *Pacu Jalur* tradition. These results are in line with the results of studies by Genci (2015) and Ibe et al. (2016), which state that the achievement of scientific literacy does not depend on the gender of the student. In addition, Piraksaa et al. (2014) also found that gender did not affect scientific reasoning ability. The gender effect was only significant in the MMM sub-context, namely selecting, cutting, and pulling the wood to the village, and in the sub-context of the MMJ, making and warming the boat. These two sub-contexts are indeed related to menial jobs, which are dominated by men. According to Jenkins (2003), gender is important in terms of traditional knowledge ownership in cultures where women and men have very different roles. Although there is a significant difference in scientific literacy abilities, these abilities are in an unsatisfactory category.

In other sub-contexts, gender does not have a significant effect. This result is actually in line with the discussion in the previous paragraph. The low ethnoscientific literacy of students shows the inability of students to relate what is learned in science learning at school to the *Pacu Jalur* tradition. This result is in line with the low literacy gain of Indonesian students in the 2018 PISA survey (OECD, 2019). Because it is alleged that this problem is due to the lack of emphasis on the context of the *Pacu Jalur* in teaching science, especially physics, this of course has the same impact on male students and female students. The amount of scientific conceptual knowledge that a person has acquired does not make individuals scientifically literate, but the number of problem-solving skills, communication skills, critical thinking skills, and positive social cognition skills that an individual has developed (Ibe et al., 2016).

Although the ethnoscientific literacy of students is at a low level, we have found that the excitement of the *Pacu Jalur* event has a positive impact on students' ability to explain the *Pacu Jalur* tradition scientifically. Students who are in an area that is carrying out a *Pacu Jalur* event are better at explaining the *Pacu Jalur* scientifically, as well as students who are in an area that is preparing for a larger event. These results indicate that this cultural tradition has good potential to improve students' scientific literacy, but this effort needs to be supported by making cultural traditions the main context in science learning on relevant topics. This view is following the results of the study of Mania and Alam (2021) who found that a culture-based (mathematical) learning approach made it easier for students to understand the concepts being taught. Meanwhile, according to Cansiz and Cansiz (2019), preparing scientifically literate students is the ultimate goal of the learning process, therefore in the teaching and learning process of science, aspects of scientific literacy need to be approached holistically. Therefore, science teachers must optimize the local

context to produce holistic and innovative teaching. Scientific literacy can be developed using various innovative science learning strategies (Lestari et al., 2020).

CONCLUSIONS

Through this study, we found that student's ability to scientifically explain their local cultural traditions was still at a low level. Local cultural traditions that have been passed down from generation to generation and have even become an annual regional and national event, do not have a significant impact in increasing ethnoscientific literacy. Direct involvement of students in cultural traditions or just as spectators has little effect on this literacy. In general, gender does not affect students' ethnoscientific literacy, although male students are more directly involved in this cultural tradition. The difficulty of students connecting the science they learn in school with what they witness or experience in their cultural traditions is strongly suspected to be caused by the less optimal use of local cultural traditions in the context of teaching science. However, the atmosphere of the cultural tradition event itself has an impact on strengthening students' ethnoscientific literacy. This gives hope that local cultural traditions can be optimized to improve students' scientific literacy.

Realizing that the weak ability of students to explain their local cultural traditions scientifically is more due to the lack of emphasis on the context of these traditions in teaching science, educators should be able to optimize the context of these traditions in teaching science. For this purpose, science teachers must explore local cultural traditions to map aspects of science with aspects of local cultural traditions. And then, science educators can teach science by prioritizing the use of the context of the local cultural tradition. Science teaching that does not connect science learned at school with the context of students' lives makes science meaningless for students.

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