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STUDENTS WATER LITERACY IN SOUTH SUMATERA INDONESIA, DOES INDIGENOUS CULTURE HAD INFLUENCE?

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Abstract. Water literacy, or the culmination of water-related knowledge, attitudes and behaviours, is a relatively new field of study with growing importance for sustainable water management and social water equity (McCarroll & Hamman, 2020). This study aims to analyse students' water literacy from two area in South Sumatera Indonesia, one area is from Semende which is subdistrict of Muara Enim with Indigenous Culture of water conservation and other students came from Palembang Districts which is at the same province with Semende districts, with a similar abundance of water but without Indigenous Culture. This study's samples were 439 respondents, consisting of 184 boys and 255 girls aged 11-18 years from junior and senior high school students in Palembang Municipality and Semende sub-districts of Muara Enim. There were 39 questions for measuring water literacy in the form of a Likert scale (1-5) to assess knowledge, attitude and behaviours in practical and living literacy. Social literacy was measured in the open-ended question instrument. Three of this water literacy was analysed descriptively. The results showed that practical water literacy in Semende and Palembang was significantly different but not with living water literacy. Besides, students' social water literacy in the Semende had two different answer patterns, while, in Palembang, it was more diverse with six different response patterns.

Keywords: *Water literacy; South Sumatera; Indigenous Knowledge*

I. INTRODUCTION

Water is a significant need for humans because humans can only live four days without water (Towell, 2009). Water also has a strong relationship with food security, which can only produce food if adequate water reserves are available (Maréchaux et al., 2015). Lack of water will trigger many problems, such as food shortages, disease emergence, and other future problems. Moreover, an increase in the world's population will increase water consumption, especially by individuals and agriculture as the largest absorber of water supplies (60%) of the total freshwater availability on Earth (Harlan et al., 2009).

Even though the environmental and conservation education curriculum has convinced many people about environmental problems, such as waste recycling,

deforestation, global warming, greenhouse gases, and climate change (Gratiela & Saracli, 2019). The issue of water availability tends to be neglected in Indonesia. The environmental problems above, especially climate change, will impact the existence of water, and Indonesia is predicted to experience water scarcity in 2025 (Royyani, 2017).

Lack of attention to water problems, especially in Indonesia, can be seen from a large number of rivers, but clean water availability decreases (Mawardi, 2010). Besides, the only research on water literacy in Indonesia showed that water literacy among the middle economic population aged 25-36 was still low. The data revealed that women's water literacy was lower than in men (Febriani, 2017), even though women play a dominant role in household water use policy (Wutich et al., 2020). Additionally, children and adolescents' practice of water literacy is more influenced by

habituation and family economy factors (Owen-Smith, 2009; Spaargaren, 2004).

Water literacy is the knowledge about water and its application to daily values and actions consciously (Wood, 2014). This definition develops into the ability to be familiar with and get actively involved in water to face issues about it (McGuinness, 2020). This development makes water literacy measured not only based on cognitive and affective but also conative scope aspects. More specifically, practical water use in individual daily activities and living water literacy in family daily activities. Meanwhile, social water literacy is the willingness to take the proper water availability solution, management, and use in the community (Otaki et al., 2015).

Several researchers have conducted research measuring water literacy in various places such as at elementary to university students in the US (Covitt et al., 2009), on students and parents in Nottingham, UK (Wood, 2014), in Australia (Fielding et al., 2015), in adults with middle economic levels in Indonesia (Febriani, 2017), in China (He, 2018), and in Nigeria (Onukogu et al., 2018). However, the study only focused on the behaviour and amount of water use in individual and family daily activities (practical and living water literacy), not social water literacy. There are several studies on the influence of community culture on behaviour, such as the study by Sreen et al. (2018) regarding the impact of local knowledge on buying behaviour for environmentally friendly products and study reporting the relationship between food, eating behaviour, and culture in Chinese society (Ma, 2015). However, no one has examined the relationship between water literacy and water indigenous culture.

As the research area in this study, Semende is an area located in South Sumatra Province. Based on research, this area has a water indigenous culture in the form of *tebat*, *tambak ayik*, and *bubustebat* (Authors). *Tebat* is a pond with functions to collecting water from mountain springs for the irrigation of rice in the fields, keeping fish, and fulfilling household water needs, including bathing, washing clothes, and the management of mini power plants. *Tambak ayik* is part of the reuse water cycle, while *calak badawan* is taboo to protect the *tebat* and springs from human activities. Furthermore, *bubustebat*, which requires draining to harvest fish, is part of an effort to maintain a sense of communal ownership and the *tebat* (Meilinda et al., 2021).

This Indigenous culture can make most areas in Semende have an abundance of water so that it is designated as a water conservation area by the Muara Enim regency government. In the same province in South Sumatra, the capital city of Palembang is also an area rich in water. The area has the largest river in Indonesia (The Musi River) with a length of 750 km (15 km across the Palembang area), a depth of 8-12 m, and a width of 220-313 m. Apart from the Musi River, Palembang also has four other rivers: the Ogan, Komering, Kramasan, and Terusan rivers (Suryani, 2016). Even though they are in the same province, there is no specific Indigenous culture related to water conservation in the Palembang area in as much as the people living there

were originating from different areas and continue to live within its urban environment. They shared a physical disconnection from their ancestral homeland while living in the city.

Analysing the differences in water literacy at the practical, living and social components of students in different areas with and without indigenous culture related to water conservation can be a reference for understanding indigenous culture influence to students water literacy and the finding of the research can give feedback for developing a water sustainability curriculum based on the local community conservation.

II. FRAMEWORK

Water literacy is the knowledge about water and its application to daily values and actions consciously (Wood, 2014). The framework for measure water literacy using Otaki et al. (2015). There are three parts of water literacy: practical, living, and social water literacy. Practical water literacy is the practice of knowledge and water use in everyday life on an individual scale, such as knowing the basic requirements of clean water for consumption and individual sanitation, e.g., drinking and washing hands. Living water literacy is an effort to get the best quality and quantity of water for the scale of the family's interests, such as collecting and utilizing rainwater, setting the distance of septic tank and clean water wells, and selecting water sources for family consumption. Meanwhile, social water literacy refers to the willingness to take the suitable solution regarding water availability, management, and use in the community. Further, the framework from Otaki et al. (2015) is combined with the measurement of cognition, affection, and conation in practical and living water literacy based on the tripartite theory developed by Ajzen (1991).

On the other hand, Indigenous knowledge is original knowledge that refers to the understanding, skills, and philosophy developed by local communities, which arise from long interactions with the natural surroundings. Indigenous knowledge is also a part incorporated and directly integrated with cultural complexity, including language, classification systems, resource use practices, social integration, rituals, and spirituality; thus, for Indigenous peoples, Indigenous knowledge becomes a source of fundamental decision-making about daily life (Mazzocchi, 2006). For rural and indigenous peoples, local knowledge informs decision-making about fundamental aspects of day-to-day life. This knowledge is integral to a culture complex that also encompasses language, social interactions, ritual and spirituality (ICSU, 2002).

There are many Indigenous cultures in water management such as Borona and konso in Ethopia. It is famous for its interesting tradition of terracing as an effort to conserve water system for the long run. This tradition know as Gedaa has proven to protect water and land resources (UNESCO, 2010; Arsano, 2007). Another example is the Qanat in the areas of Morocco, Spain, Syria, Iran, Central dan Eastern Asia. It has been wide spreadly used for a long

period of time. The system has shown to lengthen life expectancy of living things in the desert (Canavas, 2014; Hartl, Beaumont, Bonine, & McLachlan, 1989). It is a technique to stream water from central well on the hill slopes to the lowland through underground tunnels for domestic necessities and irrigation. Additionally, the underground tunnel can minimize evaporation (Canavas, 2014). Furthermore, indigenous culture in water management also exists in Indonesia, particularly in the area of Semende, South Sumatra. The systems are known as *tebat*, *calak badawan*, *tambak ayik*, and *bubus tebat* (Meilinda et al., 2021).

Indigenous culture starts from indigenous knowledge, unlike the modern formal education, it uses various ways, such as storytelling and ceremonies to instill values in community (Graveline, 2002, Peat, 1994). Many studies on Indigenous (Denzin et al., 2008; Kovach, 2010) revealed that storytelling is a traditional method used to teach about cultural beliefs, values, rituals, history, daily practices, relationships between individuals, and ways of life, conveyed orally. such as Scroggie and Dargay (2009) state that

“storytelling is a traditional art form that has been practiced for thousands of years in every social and cultural community in the world”

The linkage framework between indigenous culture as a part of indigenous education, water literacy, and formal education described above is in Figure 1

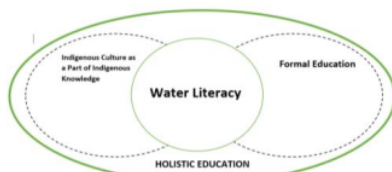


Fig 1. Water literacy in indigenous culture and formal education

42 countries, and the results of the 2015 Program for International Student Assessment (PISA) survey which put Indonesia in the 62nd rank from 72 countries (OECD, 2015). Studies conducted by TIMSS and PISA show that the scores of Indonesia are still below the international average. The questions used in the TIMSS and PISA studies consist of problems to measure higher order thinking skills, one of which is critical thinking skills.

The learning process in class is generally still not optimal, especially in teacher's selecting and using appropriate learning models to deliver learning material and objectives. Many teachers still use direct learning that trains the critical thinking skills of students less optimally (Jumaisyaroh et al., 2015). Besides, students are not given the opportunity to construct their knowledge, making them less involved in the

III. METHOD

Research Area

Research Area and population sample in this study, the research target population was junior and senior high school students in Palembang Municipality and three sub-districts in Muara Enim Regency, namely Semende DaratLaut, SemendeDarat Tengah, and Darat Ulu sub-districts, South Sumatra Province, Indonesia. The selection of Semende and Palembang Municipality was due to several similar characteristics, including (1) both are in the South Sumatra Province shown in Figure 2. Both are in areas with abundant water sources. The difference is that Semende has indigenous culture which is connected to water management and because of this, Semende area has much water resources and this area became water tourism (Authors). Meanwhile, Palembang is the capital of South Sumatra Province with many water resources in the form of a large river that divides Palembang into two parts: the ulu and the ilir area. The river is called the Musi river that crosses Palembang 15 km from a total length of 750 km, a width of 220-313 m, and a depth of 8-12 m. Besides, there are several other large rivers, such as the Ogan, Komering, Keramasan, and Terusan rivers, as well as peat swamp areas. There is no data on the size of the peat swamp areas in Palembang. Thus, the two areas have abundant water resources. Moreover, there have not been many studies that distinguish water literacy in areas with abundant water resources. No one has yet examined whether areas of abundant water and Indigenous culture affect water literacy.



Fig 2. Palembang and Semende area with white line border

The Palembang area's target population was 206 junior high schools and 201 senior high schools/vocational schools, both public and private schools in modern city living. Meanwhile, Semende only consists of three sub-districts with 14 junior high schools and three senior high schools/vocational schools in rural area. There is no data obtained on the number of students at DAPODIKNAS (the official website of the Ministry of Education and Culture of the Republic of Indonesia).

Instrument

The instrument consisted of three parts of water literacy: practical, living, and social water literacy. The questions developed are validated using the Content Validation Ratio

(CVR). A validation is the reference that shows the validity of research to claim what is measured for accurate conclusions (Nkwakem 2015). It was validated by five environmental experts. The resulted data were processed with *Content Validation Ratio* (CVR) and was calculated using Lawshe Equation (1975), as follows:

$$CVR = \frac{n_e - \frac{N}{2}}{\frac{N}{2}}$$

In which:

n_e = Numbers of validators stating the item is valid

N = Total Number of validators

Every "yes" from the validators count as 1. CVR calculation results for every items were compared to the content validity Index (CVI) with the category in Table 1.

Table 1
 Category CVI

Range	Category
$CVI \geq 0.68$	Very valid
$0.34 \leq CVI < 0.68$	Valid
$CVI < 0.34$	Invalid

(Wilson, Pan, Schumsky, 2012)

The initial numbers of items and its corresponding numbers after validation based on the CVR calculation and category are described in table 2.

Table 2.
 Initial Numbers Of Item And Its Number After Validation

Water literacy indicator	Initial	After Validation
Practical water literacy		
Knowledge	7	5
Affection	9	5
Behaviour	7	7
Living water literacy		
Knowledge	8	8
Affection	6	6
Behaviour	8	8

Some items in both Practical and living water literacies described in Table 2 were eliminated after the validation process through CVR test. The validity questions were tested for the reliability level of 439 students. The data on practical literacy comprised 17 questions with a Cronbach alpha reliability value of 0.692. Living literacy consisted of 22 questions with a reliability value of 0.773. Meanwhile, social water literacy employed the socio-hydrology issue framework using Semende and Palembang's local issues with the essay question, and the overall reliability value was 0.838. The example question can be seen in Table 3.

Table 3.

The Example of The Water Literacy Question		
Practical Water Literacy	Water	Living Water Literacy
If served bottled mineral water, I will drink it until it runs out		Our families have our own criteria for consumable water.
Based on the CVR calculation and category		
	Social Water Literacy	
	Semende is a mountainous area in Muara Enim Regency that has the <i>tunggu tubang custom</i> . <i>Tunggu tubang custom</i> is obligation to maintain a family legacy of rice fields and ensure rice production. Several habit take place from generation to generation; maintaining tebat, which is a spring reservoir for irrigating rice field called <i>hulu ayek</i> forest; using spring or <i>ayik ntup-ntup</i> as household water consumption and <i>tambat ayik</i> as an effort to utilize the flowing water as much as possible before is returned to nature such as from the tebat to rice fields, the fish pond, the rice fields, then into the river.	
	Based on the above discourse, answer the following questions: of the habit related to water conservation mention above, the section is related to: Spring's Protection High-quality drinking water usage Water reuse	
	If the people start to ignore the custome of <i>tambak ayik</i> , do you think it will be disturb water availability in the area? Please explain your answer along with the reason	

In capturing many respondents, several approaches were taken, including using teachers and peers as surveyors. Data were taken via Google Forms from June to September 2020 through volunteer teachers who distributed the form to junior high and senior high school students in Semende and Palembang area. The instrument used Indonesian and distributed using Google Forms with the address bit.ly/WaterLiteracy for safety during the corona epidemic. Due to the internet network's difficulty, some data were filled in paper and pencil form, especially from the Semende area. From Google Forms and the paper and pencil form questionnaires distributed, there were 729 respondents. Some questionnaires from these respondents were discarded for several reasons, such as (1) answering on the same scale from the beginning of the questions to the end even though some of the statements presented were conflicting questions; 2) filling in a few statements, while the rest are left blank; 3) several respondents who were not from the research target area. The questionnaire results analyzed were 439 students aged 12 to 18 years.

Overall, 439 students aged 12 to 18 years were involved, from two regions, namely 365 students from Palembang and 74 students from Semende. Those 439 students consisted of

255 girls and 184 boys. The Semende community is a rural community with a low level of economy and education, but this area has an Indigenous culture of water conservation. Because of this Indigenous culture, water conservation has been built in this area; even the existing water sources can be the source of electrical energy and a tourist area. Meanwhile, Palembang is the capital of South Sumatera Province with many water resources and swamp areas, so that the Palembang has an abundance of water resources similar to the Semende area

Data and Analysis

For analysing students' responses recorded on Google Forms and survey sheets, the researchers used Microsoft Excel. The researchers converted students' responses into numeric scores. The scale items of practical and living water literacy on the Likert scale were 1 for strongly disagree to a score of 5 for strongly agree. Participants' responses to each scale for practical and living water literacy were analysed descriptively by comparing samples from Semende and Palembang in practical, living, and social water literacy indicators.

IV. RESULT

This section presents the findings of practical, living and social water literacy descriptively in Semende and Palembang.

Practical Water Literacy. Practical water literacy is individual water literacy practice based on the validity and reliability of test results. This section consists of seven cognitive questions, five affective questions, and five conative questions.

On practical water literacy level, students both from Semende and Palembang had the same pattern on cognitive, affective and conative questions except on affection section. On cognitive level, the knowledge of both groups of students were similar in regard to the necessity to boil water before consumption, the characteristics of consumable water and its amount, the relationship between water cycle and the availability of consumable fresh water. However, on affective level, higher number of students from Semende preferred to drink boiled water from their own spring to drink mineral water (77%) as compared to those from Palembang (15%). Furthermore, also on the same level, almost all (84%) students from Semende enjoy taking a bath with well water and only small numbers (15%) of students from Palembang enjoyed the same. Well water in Palembang was pumped from sement covered well and was stored in small tubs. On the questions of time taken to finish a bath, students from Semende took longer time than those from Palembang. It was related to the preference of bathing habit of Students from Semende to bath in river or natural pond than to do it in bathroom. Furthermore, an adequate number of students from Palembang (31%) prefer to bath in swimming pool. Bathing in river was not an option since it was not suitable or too dangerous for swimming.

Living water literacy

Living water literacy means using water wisely in the home and backyard social space and ensuring a quality water supply so that everyone as family's member has enough water for a healthy life. Based on the validity and reliability test result, 22 questions consisted of eight cognitive, six affective, and eight conation questions.

Generally, there were no difference of living water literacy between students from Semende and Palembang. They had similarities in However, in several respects, there were several diffences as described in Table 4.

Tabel 4.
 Statements of living water literacy indicators Difference between Students from Semende and Palembang

Number	Statement
25	Rainwater can be directly used for family consumption
31	consumption
32	Our family likes to save wáter to save money
38	Our family prefers to save wáter because they understand that the amount of wáter consumption is limited
40	Our family use a wáter dipper to bathe
	My parents always remind me to save wáter usage

Statement 25 was agreed by more students from Semende with a percentage of 41%, while Palembang only by 25%. The data showed that students from Semende often played and drank rainwater straight when it came down to earth. In statement 31 and 32, Families of students from Semende took economy consideration as the main factors to save water as compared to families of those from Palembang who took the amount of clean water as their consideration.

In question 38, the family's bathing habit used a water dipper to take water in a tub as a part of living water literacy. The data revealed that 78% of students from Semende and 84% of students from Palembang made that bathing habit. The lower percentage of using a water dipper to take water in a tub at Semende students did not mean they did not like using it; the environment factor made them prefer to bath in a bath, pool, fountain, or river. Meanwhile, in the 40th statement, 74% of students from Semende and 89% of Palembang students had parents who reminded them to save water

Social Wáter Literacy

Social water literacy refers to the willingness to understand and make reasonable decisions for the community about water usage. To have good social water literacy, one must have the ability to understand water resources, water treatment, water flow, and wastewater treatment. Although practical and living water literacy is

literacies in everyday life, social water literacy has a broader perspective, such as eutrophication. Eutrophication is the abundance of chemical nutrients caused by nitrogen and phosphorus being discharged into water from waste and the environment's water cycle [14].

In social water literacy, combining the Semende and Palembang areas' social context, the first question was related Indigenous culture in the form of *ulu ayek forest*, *tebat*, *ayik ntup-ntup*, and *tambat ayik* in water literacy in the Semende region. Although this Indigenous culture was not officially taught in schools, most students from Semende (82%) understood the role of Indigenous culture in water conservation, such as *tebat* as a part of efforts to maintain water resources, *ayik ntup-ntup* as an effort to maintain quality drinking water, and *tambak ayik* as water reuse cycle efforts. However, some students still thought that ignoring Indigenous culture would not disturb the existence of water in Semende. The presence of abundant water in Semende is caused by 1) the position of Semende in the mountains and hills; 2) there is a forest in Semende; 3) swift flow of the water in Semende will not decrease; 4) water needs have been fulfilled from the flow of pipe from the house to house, starting from mountain spring, specifically for consumption called *ayik ntup-ntup*.

Social water literacy with the context of the problems in Palembang, such as neglecting the existence of retention pond, covering the land with roads or building, and even dumping garbage into the water, students from Semende could answer well by stating that those would disturb the existence of river water and clean water sources in the city of Palembang. The students who came from Palembang had a different pattern in answering from Semende Students. Semende students had two answer patterns: 1) realizing that the existence of Indigenous knowledge is a logical effort to conserve water in the area and 2) there is no relationship between Indigenous culture and the presence of water in the area; a large amount of water in Semende is because of its mountainous areas. Meanwhile, students from Palembang municipality had more varied answers.

There were three responses from students from Palembang regarding social water literacy in Semende: 1) Indigenous culture of Semende is significant to be preserved because it is an ancestral heritage and scientifically maintain the existence of water in nature. Neglecting them can harm society and the environment (55,7%); 2) Disregarding customs will not have any influence on the presence of water in the environment because of its abundance in nature as Semende is located in mountainous area with many trees; water depend on the weather and rain (27,3%); 3) and without reason (18,4%).

Palembang students' answers stated that neglecting the indigenous culture affected water's existence since the tradition is an ancestral heritage. In the Semende student statements, there was no statement regarding customary violations that reduced water due to the existence of Indigenous culture carried out by the Semende community, such as *tebat*, *ulu ayek forest*, *tambak ayik*, and *ntup-ntup*, which has been part of daily community habits without

being mixed with cultural ritual understandings, as students' answer from Semende in this dialogue

Question : "If the people in Semende no longer practice the traditional *tambak ayik*, will it reduce the amount of water in the Semende area?"

Answer :

(student 1) "No, because Semende is in a hilly area, so the water will not decrease."

(Student 2) "No, because water is still stored in the forests."

(Student 3) "No, because the amount of water in Semende is large and flows swiftly so that people in Semende will not be short of water. Even so, the answers they gave were not wholly correct, and even many had misconceptions, as can be seen in dialogue above.

Concerning the cultural knowledge understanding in Semende, students believed that there were watch men in *tebat*, so they believed that there was the taboo of throwing trash and polluting springs, bathing for menstruating women, and defecating [22]. This cultural knowledge understanding made students take good care of their water resources, specially *tebat*. From the interview, some students did not know the reasons behind their behaviours and only adapted from the surrounding environment. One of them was the students' parents, who always reminded their children to save water due to economic factors (74% from Semende and 89% from Palembang).

Based on the distributed questionnaire, data were also obtained that the students' parents in Palembang had better formal education than Semende. It could be seen from the number of parents from Semende who graduated from senior high school by 36.4%, bachelor only by 7.4%, and the rest did not go to school. Meanwhile, from Palembang, 51.8% graduated from senior high school, and 8.6% bachelor graduated.

V. DISCUSSION

Education about water in primary and secondary schools in Indonesia has not become a special concern even though water scarcity is predicted to become a big issue by 2025 in Indonesia (Royyani, 2017). The study results found that the water literacy of Semende students on practical water literacy indicator was significantly different compared to Palembang students, especially in affective aspects, such as preferring to consume well water than gallon water and preferring to bathe in tub water or rivers. The difference in practical water literacy between Palembang and Semende students was more influenced by the environment in which they grew up. Leveque and Burns (2018) and Qian (2018) state that people's perception of water is influence by the habit around them as they grow. Regarding this, Semende is a mountainous area with many rivers and ancestral heritage ponds. Thus, bathing in the river and *tebat* have become a daily habit. It was different from students from Palembang. Although Palembang was once called "Venice from the east" because of its many rivers and water canals, people rarely swim in rivers or ponds because the river conditions

are not safe for children and teenagers to swim. Besides, they have to pay much money to swim in the pool. Thus, it could be concluded with an economic condition like in adults (Wood, 2014), but the satisfaction level more influenced it in using water, such as frequency of water use for bathing and (Dean et al., 2006). It follows the study's findings, revealing the number of Palembang students who bathed less than 20 minutes compared to Semende students.

Living water literacy is an effort to get the best quality and quantity of water for the scale of family interest, such as storage and utilization of rainwater, setting the distance of septic tanks and clean water wells, and selecting water resources for family consumption (Otaki et al., 2015). And from this research it was found that living water literacy decisions did not depend on the student as the research respondent but depend on parents especially mother. Adults generally know what they have to do to conserve water. However, Owen et al. (2009) stated that these adults do not know the reason behind their behaviors, the water conservation behavior only adapted from the surrounding environment.

Knowledge becomes another factor in saving water besides the economy. Several studies have found that education level affected water literacy in children and adults (Castello, 2002; Johnson & Courter, 2020), but others assume that it was not the education level but the knowledge they had about water (Dean et al., 2016; Spaargaren, 2004; Wood, 2014). In this case, Indigenous culture is a tool that shapes students' knowledge and perceptions (Bistari, 2017) Including about the environment such as water (Stables & Bishop, 2001) as Masuku (1999) and Darmadi (2018) states that for traditional societies, myths, taboo, and local wisdom are effective educational tools to educate their people.

VI. CONCLUSION

People's perception of water is influence by the habit around them as they grow. Indigenous culture is a informal education in a traditional community passed down from generation to generation. In urban area Indigenous culture is a tool that shapes students' literacy about water, especially in Semende the area.

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