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Developing of an Environmental Literacy Instrument: It is Suitable in the Context of Aboriginal Students

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Abstract

Environmental literacy instruments developed by previous researchers do not take into account the background of the younger generation of aboriginal students who have undergone a change in the social and economic aspects of the present day. In response, this study aimed to develop an environmental literacy instrument in the context of indigenous students in Malaysia. The instrument development in this study involved five stages, namely conducting analysis of literature review, performing expert validation, carrying out a pre-test, conducting exploratory factor analysis (EFA), and performing reliability analysis. In this study, the 56-item survey consists of 20 questions on knowledge about the environment, 21 items on environmental intrinsic factors and 15 items on environmental behavior. The questionnaire was administered to 400 indigenous students at the primary and secondary school level (ages 11 to 14 years old). Exploratory factor analysis indicated that the 25 items on intrinsic factors were grouped into four factors, namely attitude, locus of control, personal responsibility and environmental beliefs. The Kuder-Richarson for knowledge about the environment was 0.60 while the Cronbach's alpha values for intrinsic factors were .802 for attitude, .705 for locus of control, .708 for environmental beliefs and .703 for personal responsibility. The Cronbach's alpha value for environmental behavior was .882. This instrument is helpful in research and evaluation that is aimed at measuring environmental literacy for environmental conservation in the context of indigenous students.

Keywords: Environmental Behavior, Environmental Literacy, Exploratory Factor Analysis, Instrument on Environmental Literacy, Indigenous Students

Introduction

The Aboriginal people are well-known as a community that is innately close to the environment or nature (Department of the Indigenous Affairs, 2011; Salleh, 2012; Jelas, Ahmad & Ayudin, 2009). However, the changes in the lifestyles of the aboriginal

community today have led to changes in terms of their way of thinking, attitude and behavior especially among the younger generation of the aboriginal community (Nicholas & Lasimbang, 2004). In the past, the Aboriginal community/aboriginal community only used natural resources for their daily needs, but this has changed where presently the exploration of environmental resources is carried out more for commercial or economic value (Chopil & Hunt, 2009; Nicholas & Lasimbang, 2004). Moreover, the lack of belief in the environment among the younger generation has led them to no longer hold on to the traditional values that control their behavior toward the environment (Department of the Indigenous Affairs, 2011).

Environmental literacy is important in solving environmental issues (Hungerford et al., 2005; Palmer, 1998; Palmer & Neal, 1994; United Nations, 1992). Environmental literacy may differ due to internal and external conditions of each individual (Ateria, Herdiansyah & Apriana, 2016). Most environmental literacy instruments developed in previous research are based on the theory of environmental behavior (Goldman & Pe'er, 2006; Bodur & Sarigollu, 2005; Oreg & Katz-Gerro, 2006). The theory of environmental behavior is also more general and does not take into account the background of the respondents involved (Ajzen, 2005; Emmons 1997; Stern 2000) especially aboriginal students who have presently undergone changes in terms of social and economic aspects.

Furthermore, the Aboriginal people's beliefs about the environment which control their behavior toward the environment should be taken into consideration in studying environmental literacy among aboriginal students. Among the beliefs of the aboriginal people in relation to the environment are that the forest is considered sacred because it is guarded by gods or guardians, the natural resources can only be taken according to need, and the destruction of the environment will evoke the anger of the supernatural powers which will bring about disaster in various forms such as floods, drought, disease or death (Chopil & Hunt, 2009; Jelas, Ahmad & Ayudin, 2009; Nicholas & Lasimbang, 2004; UNEP, 2008).

Accordingly, environmental literacy inventories among aboriginal students need to be implemented to guide the planning of the environmental education program. Therefore, an environmental literacy instrument that is appropriate to the context of aboriginal students needs to be developed in line with the changing lifestyle of the aboriginal community today. Since belief plays an important role in controlling environmental care behavior, environmental beliefs need to be considered as part of environmental literacy among aboriginal students. Additionally, aboriginal students are often associated with a lack of self-confidence (Jelas, Ahmad & Ayudin, 2009; Salleh, 2012). Therefore, the factors of locus of control related to self-confidence should also be taken into consideration in measuring environmental literacy among aboriginal students.

Hence, environmental literacy investigated in this study are knowledge of the environment, attitude, personal responsibility, locus of control, environmental beliefs and environmental care behavior toward the environment. In this regard, instruments

that measure environmental literacy appropriate to the context of aboriginal students should be developed so that the outcome can provide real information about the environment of the aboriginal community's lifestyle. Environmental inventory among aboriginal students can also provide guidance in environmental management planning in the future.

Literature Review

Environmental Literacy

In the early stages, the researcher conducted literature review related to environmental literacy to understand the meaning of environmental literacy as well as trends in environmental literacy studies. The search results show that environmental literacy encompasses elements of knowledge, skills, attitude, values, responsibility and actions (Elder, 2003; Hungerford & Volk, 1990, 2005; Roth, 2002; Sia, Hungerford & Tomera, 1985; 1986). There are studies on environmental literacy that focused on content analysis of textbooks (Karatekin, 2012; Karimzadegan & Meiboudia, 2012) and science curriculum (Srbinovski, Erdogan & Ismaili, 2010). The results of these studies show that the textbooks and science curricula emphasized more on environmental knowledge than other environmental literacy components such as attitude, personal responsibility, beliefs, locus of control and behavioral change (Karatekin, 2012; Karimzadegan & Meiboudia, 2012; Srbinovski, Erdogan & Ismaili, 2010).

Saribas, Teksoz & Ertepinar (2014) conducted a study on correlation among environmental literacy elements. The findings reveal a positive correlation between self-efficacy beliefs and environmental concerns. Their findings also show that participants did not have enough self-efficacy knowledge and beliefs despite having high attitude, concern and perception of environmental issues. Other previous studies also found positive relationship between knowledge and attitude (Meinhold & Malkus, 2005; Pe'er, Goldman & Yavetz, 2007; Tiwi, 2006; Zarrintaj et al., 2013), and environmental awareness (Norjan et al., 2005). However, Hsu (2004) and Prabawa-Sear & Baudains, (2011) claim that knowledge alone cannot change behavior toward the environment. This is evidenced by the study of He et al. (2011) who found that even though the environmental knowledge of the students in their study was at a low level, they had positive attitude and behavior toward the environment. However, He et al. (2011) emphasized that knowledge is important in understanding the effects of human behavior on the environment (He et al., 2011).

There are also other previous studies that examined the relationship between attitude, personal responsibility, locus of control and environmental care behavior. The findings show that attitude (Bodur & Sarigollu, 2005; Hsu & Roth, 1999; Kasapoglu & Ecevit, 2002; Kuhlemeier et al., 1999), personal responsibility (Hsu & Roth, 1999) and locus of control (Bodur & Sarigollu, 2005; Hsu & Roth, 1999; Kasapoglu & Ecevit, 2002) have a significant relationship with environmental behavior. Factors that contribute to behavior are important to study as the final goal in environmental literacy is environmental behavioral change (Elder, 2003; Hungerford et al., 2005). The relationship between environmental literacy elements is important in providing

understanding toward enhancing environmental literacy at the operational level. At the operational level, individuals are able to collect and evaluate information on environmental issues, choose among the various options, and take decisions as well as environmental actions appropriate to the environmental value held (Moseley, 2000; Roth, 1992).

The method of teaching environmental education also affects environmental literacy among students. Febriasari & Supriatna (2017) found that problem-based learning involving four levels of planning, implementation, observation and reflection can improve environmental literacy among primary school students in Bandung. Among the other teaching methods of Environmental Education are experiments (Palmer, 1998), field work (Arnocky & Stroink, 2011; Larson, Whiting & Green., 2011) and environmental camping (Erdogan, 2011). Previous studies also show that the application of environmental education curriculum, out-of-classroom learning and teaching characteristics contribute positively to environmental literacy (Stevenson et al., 2013). This clearly shows that students' environment which includes teaching methods, curriculum and teacher competence affect environmental literacy among students. These elements should be considered in the development of environmental literacy instruments.

Environmental Literacy Instrument Development

The researchers focused their literature search on development of environmental literacy instruments in order to develop appropriate environmental literacy instrument in the context of aboriginal students. The literature search reveals that existing environmental literacy instruments are not suitable to be used directly in the context of aboriginal students because of the different environment. Shamuganathan & Karpudewan (2015) in their study modeled the environmental literacy of Malaysian Matriculation College students and at the same time developed an environmental literacy instrument. The environmental awareness studied included attitude toward the environment, beliefs, conservation knowledge and environmental responsibility behaviors. The environmental literacy elements studied by Shamuganathan and Karpudewan support the elements contained in environmental literacy as suggested by Elder (2003), Hungerford et al. (2005) and Roth (2002). However, this instrument focuses only on high achieving students doing their matriculation or A-level in matriculation colleges.

Meanwhile, Christensen & Knezek (2015) developed a questionnaire on climate change attitude by measuring the beliefs and intentions towards the environment and climate change among Grade 8 students in the United States. It was found that the scope of the instrument developed by Christensen & Knezek (2015) is incompatible with the context of Aboriginal students as the focus on climate change would be difficult for Aboriginal students to perceive and understand because of the differences in their residential environment. Moreover, the environmental issues of climate change cannot be seen directly by the Aboriginal community.

Additionally, previous studies by Shamuganathan & Karpudewan (2015) and Christensen & Knezek (2015) examined the element of environmental belief as a factor of environmental literacy. However, the environmental belief factor studied by these researchers focused on environmental belief in general (Shamuganathan & Karpudewan, 2015; Christensen & Knezek, 2015). This is contrary to the beliefs held by the aboriginal people about the environment because their beliefs contain religious elements such as the belief that forests are guarded by gods, the forest is sacred and the destruction of the environment will bring about disasters (Chopil & Hunt, 2009; Nicholas & Lasimbang, 2004).

Apart from the belief in the environment, He et al. (2011) and Elder (2003) emphasize that knowledge is an essential element in environmental literacy and is a prerequisite for changing environmental care behavior. However, many past studies, such as the study conducted by Shamuganathan & Karpudewan (2015), measure knowledge of environmental issues based on perception in general and use likert scales for measurement. In addition, knowledge of action strategies on environmental issues is also important in demonstrating action (Hines et al., 1986, 1987). However, knowledge of action strategies on environmental issues has been paid little attention in previous studies. Based on the reason that environmental knowledge and environmental action knowledge are related to cognitive factor, environmental knowledge instruments are thus measured using tests rather than likert scales.

Environmental behavioral change is the ultimate goal of environmental literacy. Hence, environmental literacy studies also need to be based on the behavioral theory of environmental protection. The conventional environmental behavior theory states that by enhancing environmental knowledge, awareness will develop, and environmental care behavior will increase (Ramsey & Rickson, 1976). However, in reality environmental care behavior is influenced by many factors and is complex. Elder (2003) claims that behavior is the top level in environmental literacy ranging from awareness, knowledge and attitude. However, like many models, these steps overlap with real life. Hence, based on analysis of previous studies, environmental literacy in the context of aboriginal students is measured based on knowledge elements, attitude, personal responsibility, environmental beliefs and environmental care behavior. Environmental issues studied in environmental literacy are tailored to the context of the aboriginal students' environment and their ability to achieve environmental literacy. Among the environmental issues faced by the aboriginal people are river pollution, extinction of flora and fauna species, and solid waste management. These issues are the primary focus in the development of items for environmental knowledge and environmental care behavior for aboriginal students.

Research Methodology

Context of Study

The environmental literacy instrument developed focused on aboriginal students at the primary and secondary level between the ages of 11 to 14 years old. Data used in the validation process were collected from 400 indigenous students in one of the 13

states in Malaysia, namely Pahang. The respondents in this study represent the three tribes of indigenous people in Malaysia, namely the Malay Proto, Senoi and Negrito. For all the students, it was the first time seeing the items in the instrument. Table 1 shows the demographics of the respondents.

Table 1 Demographics of Respondents

Variable	Description	N (Respondents)
School level	Primary	250
	Secondary	195
Tribe	Malay-Proto	197
	Senoi	242
	Negrito	6
Gender	Male	207
	Female	238

Instrument Development

Five stages were involved in the instrument development, namely conducting literature review to help develop relevant items, performing expert validity, conducting a pre-test, conducting exploratory factor analysis and determining reliability. The description for each stage is described below.

Stage 1 : Conducting Literature Review To Help Develop Relevant Items

The literature review consisted of search for studies on environmental literacy. The search included the use of ERIC, JSTOR, and Google Scholar and searching under the keywords of 'environmental literacy' and 'environmental literacy instrument' beginning from the year 2000 until 2018. The literature review and theoretical framework guided the development of the initial pool of survey items, as well as other instruments that measure the environmental attitude, personal responsibility, beliefs and behavior. Description of factors contributing to environmental literacy is discussed in the literature review section. Constructs involved in this study are summarized in Table 2. The complete questionnaire is included in the Appendix.

Table 2 Constructs in the study

No	Construct	Sub-construct /Item	Adaptation Sources	Examples of Items
1	Knowledge about the environment	Environmental knowledge (b1-b12)	Constructed by the researcher based on Environmental Education Across the Curriculum guidebook (Ministry of Education)	Multiple choice answers related to the topic of river pollution, solid waste management, endangered flora and fauna species and increasing knowledge about the environment (in Appendix).
		Environmental action knowledge (b13-b20)	Goldman & Pe'er (2006)	Multiple choice answers on environmental action in situations related to issues of river pollution, solid waste management, endangered flora and fauna species (in Appendix).
2	Intrinsic factors	attitude (c1-c6)	Bodur & Sarigollu (2005); Stern et al. (1995)	I will learn how to conserve the environment.
		Locus of control (c7-c11)	Oreg & Katz-Gerro (2006)	I feel that it is meaningless for me to care for the environment if others do not care about it.
		Personal responsibilities (c12-c16)	Lam & Cheng (2006); Stern et al., (1995)	I have the responsibility to conserve the environment.
		Beliefs (c17-c21)	Constructed by the researcher based on Chopil & Hunt's (2009) statement related to aboriginal people's environmental beliefs	I believe that I need to ask permission to use environmental resources.
3	Environmental Behavior	d1-d15	Constructed by the researcher	I sort solid waste based on the type (paper, plastic and glass)

Stage 2 : Performing Expert Validity

Expert validity of the instrument was performed by engaging experts in the fields of environmental education, moral education, and rural development. These experts validated each item in terms of the content. All the experts validated the items on environmental literacy in the instrument.

Stage 3 : Conducting a Pre-Test

A pre-test was conducted in one of the indigenous primary schools in the district of Pekan, Pahang, Malaysia. A total of 6 respondents, i.e. aboriginal students aged 11 and 12 years old were involved as a focus group in the pre-test. The main aim of the pre-test was to identify the respondents' understanding of the items used in the instrument. The students were briefed on the nature of the study and how to answer the questionnaire. The students were able to understand all the items in the instrument. The time taken to answer all the items was between 15 to 20 minutes.

Stage 4: Conducting Exploratory Factory Analysis

Exploratory factor analysis takes a large set of variables and looks for ways that the data may be reduced or summarized using a smaller set of factors or components. It does this by looking for clumps or groups among the inter-correlations of a set of variables (Pallant, 2011). In this study, exploratory factor analysis was performed on the intrinsic constructs i.e., attitude, personal responsibility, locus of control and environmental beliefs of indigenous people.

Stage 5: Determining Reliability

Reliability for each construct was determined based on Kuder-Richarson for knowledge about the environment and Cronbach's alpha values for attitude, locus of control, personal responsibility, environmental beliefs and environmental behavior.

Research Findings

Exploratory Factor Analysis for Intrinsic Factors

For intrinsic factors, a total of 21 items was identified. These 21 items were subjected to principal component analysis (PCA) using SPSS version 23. Prior to performing PCA, the suitability of data for factor analysis was assessed. Inspection of the correlation matrix revealed the presence of many coefficients of .3 and above. There were three items that were not grouped into any factor component i.e., item c6 (attitude), c8 (locus of control) and c13 (personal responsibility). These items were therefore dropped from the questionnaire, and 18 items remained for intrinsic factors. The Kaiser-Meyer-Olkin value was .842, exceeding the recommended value of .6 (Pallant, 2011) and the Bartlett's test of sphericity reached a statistical significance, supporting the factorability of the correlation matrix.

Principal component analysis revealed the presence of four components with eigenvalues exceeding 1. An inspection of the screeplot also revealed a clear break after the fourth component. Therefore, there were four components under intrinsic factors i.e., attitude, locus of control, environmental beliefs and personal

responsibility. To aid in the interpretation of the four components, varimax rotation was performed. The four-component solution explained a total of 43.39% of the variance, with component 1 contributing 23.30%, component 2 contributing 7.64%, component 3 contributing 6.55 %, and component 4 contributing 5.90 % as shown in Table 3.

Table 3 Rotated Component Matrix for Intrinsic Factors

Construct	Items	Factor loading			
		Factor 1 Attitude	Factor 2 Locus of control	Factor 3 Environmental Beliefs	Factor 4 Personal responsibility
Intrinsic factors	c1	.735			
	c5	.719			
	c4	.616			
	c3	.565			
	c2	.460			
	c9		.714		
	c11		.690		
	c7		.649		
	c10		.530		
		c21			.739
	c20			.614	
	c19			.526	
	c17			.517	
	c18			.437	
	c12				.766
	c14				.576
	c15				.573
	c16				.521
Eigen Value		4.894	1.604	1.375	1.239
Variance percentage (%)		23.30	7.64	6.55	5.90
KMO test	.842				
Bartlett's test	.000*				
Df	210				
Total of variance	43.39				

Reliability of the Instrument

Based on the value of Kuder-Richarson and Cronbach's alpha, all the items showed high reliability. As shown in Table 4, the Kuder-Richarson for knowledge about the environment was .60 while the Cronbach's alpha values for intrinsic factors were .802 for attitude, .705 for locus of control, .708 for environmental beliefs and .703 for

personal responsibility. The Cronbach's alpha values for environmental behavior was .882.

Table 4 Kuder Richardson and Cronbach's Alpha for Each Construct

No	Construct	Sub-construct	Kuder Richardson/Cronbach's Alpha
1	Knowledge about the environment		0.60
2	Intrinsic factors	Attitude	.802
		Locus of control	.705
		Environmental Beliefs	.708
		Personal responsibility	.703
3	Environmental Behavior		.882

Interpretation of total Score Mean

Knowledge about the Environment

Test of knowledge about the environment was interpreted based on the mean score used by the Ministry of Education in assessing students' performance in exams. The interpretation of total score mean is shown in Table 5.

Table 5 Interpretation of Total Score Mean for Knowledge about the Environment.

Total Score Mean (%)	Interpretation of Total Score Mean
80 – 100	Excellent
65 – 79	Good
50 – 64	Average
40 – 49	Weak
0-39	Fail

(Ministry of Education, 2012).

Intrinsic Factors and Environmental Behavior

The level for intrinsic factors and environmental behavior were interpreted through the total score mean value and categorized as shown in Table 6. The total score mean interpretation for intrinsic factors and environmental behavior was adapted from Nunnally (1997) where scores are indicated as low, medium low, medium high and high based on the total score mean obtained.

Table 6 Interpretation of Total Score Mean for Intrinsic Factors and Environmental Behavior.

Total Score Mean	Interpretation of Total Score Mean
1.00 - 2.00	Low
2.01 - 3.00	Medium Low
3.01 - 4.00	Medium High
4.01 - 5.00	High

(Adapted from Nunnally, 1997).

Discussion

In this study, an environmental literacy instrument has been developed for use with aboriginal students in Malaysia. However, this instrument can be applied to the context of students of other races if they have the share the same culture and background. Based on the literature review and the findings from this study, five elements in environmental literacy have been found to be appropriate to the context of Aboriginal students, namely knowledge about the environment, attitude, personal responsibility, locus of control, environmental beliefs and environmental care behavior (Hood, 2012; Nicholas & Lasimbang, 2004; Chopil & Hunt, 2009). Knowledge about the environment was divided into two, namely knowledge of environmental issues and knowledge of environmental action. In this instrument, environmental issues focused on issues related to the lives of aboriginal people which are river pollution, the extinction of flora and fauna species, solid waste management and ways to enhance environmental education.

Knowledge-testing in the environmental literacy instrument was developed to measure aboriginal students' cognitive component of environmental issues. A recent study by Shamuganathan & Karpudewan (2015) measured environmental knowledge based on perception by using likert scale. Environmental knowledge measured in the form of perception is more likely to measure affective components than cognitive ones (McCoach, Gable & Madura, 2013). Hence, this study used a knowledge-based environmental test as an instrument to measure the aboriginal students' knowledge about environmental issues. Additionally, Abdullah & Halim (2012) also used tests to measure teachers' knowledge of the environment.

In the effort to develop an environmental literacy instrument of high validity, five stages were involved, namely conducting analysis of literature review, performing expert validation, conducting a pre-test, carrying out exploratory factor analysis and performing reliability analysis. These five stages were also part of the stages in developing affective domain-shaped instrument proposed by McCoach, Gable & Madura (2013). In this study, the 56-item survey consisted of 20 questions on knowledge about the environment, 21 items on environmental intrinsic factors and 15 items on environmental behavior. The questionnaire was administered to 400 aboriginal students (aged 11 to 14 years old) in primary and secondary schools in one district in Pahang. Exploratory factor analysis indicated that the 21 items of intrinsic factors were grouped into four factors, namely attitude, locus of control, personal

responsibility and environmental beliefs. As a result of EFA, 3 items were dropped from intrinsic factors, i.e. item c6 (attitude), c8 (control locus) and c13 (personal responsibility), resulting in a total of 18 items for the intrinsic factor constructs. C6 is related to the feeling of sadness when looking at others damaging the environment while c8 is related to self-esteem in maintaining the environment, i.e. 'I feel that taking care of the environment is something easy for me to do if I want to do it'. Another dropped item, c18, is about personal responsibility involving feelings of guilt when polluting the environment.

Overall, the instrument developed has high validity and reliability. To ensure that the instrument has high validity, the content of the instrument has been verified by experts in the fields of environmental education, moral education and rural development. Expert validity of the content ensures that the items constructed correctly measure environmental literacy (Hair et al., 2010). Pre-test was also conducted with a focus group of 6 aboriginal students to enhance the face validity of the instrument and students' understanding of the items in the questionnaire. All the students involved in the pre-test stated that they understood all the statements in the questionnaire. The values of Kuder-Richarson and Cronbach's alpha obtained for the whole construct were from 0.60 to 0.882 indicating that the items have high reliability (Hair et al., 2010). Thus, this environmental literacy instrument is appropriate in the context of aboriginal students' environment and lifestyle.

However, there are some aspects that need to be taken into consideration in using this environmental literacy instrument, namely the participating students need to have high reading skills as environmental literacy is measured based on self-report. Teachers need to help read this instrument for aboriginal students who have trouble in reading. The limitation of this instrument is also related to the environmental issues addressed which only focused on issues of river pollution, extinction of flora and fauna species, and solid waste management as these are the issues relevant to the context of aboriginal students in Malaysia. Thus, this instrument is suitable for measuring environmental literacy among aboriginal students and other students who have similar background and culture. By knowing the status of environmental literacy among aboriginal students, interventions can be systematically designed to enhance environmental literacy toward environmental sustainability.

Conclusion

Environmental literacy is important in creating a society that can solve environmental problems based on ethics and moral responsibility toward the environment. Each individual has a role in maintaining the environment. Environmental literacy inventories need to be carried out on all communities in planning programs related to environmental conservation. The aboriginal people who are well known for being innately close/intimately connected to the environment and have their own indigenous knowledge of the environment are not exempted from this role too. . However, as a result of modernization, changes have been taking place in the lifestyle of the new generation of aboriginal people especially the young ones. Therefore,

inventories of environmental literacy using appropriate instruments related to aboriginal students' life are necessary.

Environmental issues emphasized in environmental literacy tools need to be clear and relevant to the lives of aboriginal people. For example, issues of river pollution, and extinction of flora and fauna species are some issues relevant to the livelihood of aboriginal people who rely on natural resources as a source of income. They hunt, catch fish and collect forest products for sale or for their own use. In addition, as a result of modernization, the aboriginal community has been moved to the Orang Asli Resettlement areas causing the aboriginal people to face a new environmental issue i.e., the management of solid waste disposal. Hence, local environmental issues that are closer to the younger generation of aboriginal community are more relevant rather than the issues of global warming or climate change. Therefore, the selection of environmental issues in environmental literacy instruments for use with the aboriginal students should be reflective of the aboriginal students' environment.

The environmental literacy instrument developed in this study emphasizes three important elements of environmental literacy, namely environmental knowledge, intrinsic factors and environmental care behavior. The intrinsic factors are grouped into four factors: attitude toward environmental care, locus of control, personal responsibility and the aboriginal community's beliefs about the environment. These factors are included in the environmental literacy instrument as a result of literature review of previous studies and the theory of environmental care behavior. This is because environmental behavior change is the highest level in environmental literacy. It is proposed that future studies explore other elements of environmental literacy appropriate to the context of aboriginal students such as indigenous peoples' knowledge related to environmental conservation, environmental decision-making skills and acting on environmental conservation such as persuasion, taking legal action, and environmental management of the ecosystem. The theories used as the basis for developing environmental literacy instruments also need to be explored and adapted to suit the context of aboriginal students' lifestyle.

Overall, the environmental literacy instrument that has been developed in this study is suitable for measuring environmental literacy among aboriginal students because of its high validity and reliability. However, the number of items used in the environmental literacy instrument needs to be limited to avoid respondents feeling bored and losing focus when responding to the questionnaire. This limitation can be overcome by using a simpler language that is appropriate to the aboriginal students' abilities. This instrument can be used as a guideline in environmental education research to measure environmental literacy among aboriginal students.

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Appendices

Environmental Literacy Instrument for Aboriginal Students

A. Knowledge about the environment.

i. Environmental Knowledge

1. Which of the actions shown in Figure 1 does NOT damage the environment?
 - A. Washing motorcycle using soap
 - B. Dumping trash into the river
 - C. Bathing in the river using soap
 - D. Eating at the riverbank

2. What do you expect would happen to the number of fishes found in the river if river pollution is carried out non-stop for three days?
 - A. Gets reduced
 - B. Increases (reproduce)
 - C. No fish
 - D. Unchanged

3. What EFFECTIVE action can be taken to prevent river pollution?
 - A. Do not allow bathing at the river
 - B. Do not allow eating at the river
 - C. 'Love our river' awareness campaign
 - D. Do not allow fishing

4. Which of the following is NOT a threatened animal (threatened means having a small number of population and will disappear if not protected)?
A crocodile B tiger C elephant D rabbit

5. The following are actions that reduce the number of animals EXCEPT?
 - A. Keeping animals in zoos
 - B. Making clothes from animal skins
 - C. Hunting animals
 - D. Making animal-based decorations

6. Cutting trees in the forest causes animals that live in the forest lose their...?
 - I. Habitat
 - II. Air
 - III. Food
 - IV. Water

- A. I and II
- B. I, II and III
- C. I, III and IV
- D. I, II, III and IV

7. Plants give/provide us these resources:

- I. Food
- II. Medicines
- III. Water
- IV. Gold
- A. I and II
- B. II and III
- C. I, II and III
- D. I, II, III and IV

8. Which of the following is NOT a threatened plant?

- A. Pitcher plant
- B. Wild orchids
- C. Rafflesia
- D. Lotus plant

9. The following are the main causes of plant extinction EXCEPT?

- A. Burning the forest
- B. Cutting down trees in the forest
- C. Taking plants in large numbers
- D. Breaking tree branches in the forest

10. Which of the following items CANNOT be thrown into recycling bins?

- A. paper
- B. wood
- C. bulb
- D. bottle

11. Which of the following is the correct match for the type of waste and the color of recycling bins?

	Type of Waste	Color of Recycling Bin
A	Glass	Orange
B	Plastic	Chocolate
C	Paper	Blue
D	Aluminum	Green

ii. Environmental Action Knowledge

12. What can mainly be produced from animal feces?

- A. Food
- B. Fertilizer
- C. Water
- D. Medicines

13. You see your friend throwing rubbish into the river behind your house. What is the first action you will take when dealing with this situation?

- A. Scold your friend
- B. Advice your friend not to throw rubbish into the river
- C. Tell the Tok Batin of your friend's action
- D. Not bothered to do anything

14. You want to get rid of the garbage after you have eaten near the riverbank. You see that the trash bin near you is full of rubbish. What is your action?
- A. Leave the garbage near the base of the trash bin
 - B. Leave the garbage where you ate
 - C. Look for another trash bin and throw the garbage in the bin
 - D. Dump the garbage at the base of a tree
15. You see an injured bird. What are you going to do?
- A. Bring the bird home to take care of it and let the bird go when it is better
 - B. Take care of the bird and put it in a cage to keep as a pet
 - C. Sell the bird
 - D. Not bothered to do anything
16. Your father wants to buy a jacket and asks you to choose for him. Which of the following types of materials would you choose for the jacket?
- A. Goat's fur
 - B. Sheep's wool
 - C. Tiger's skin
 - D. Cotton
17. You see that your friend is deliberately breaking tree branches in the forest. What is your FIRST action?
- A. Advise your friend not to break the tree branches
 - B. Scold your friend for breaking the tree branches
 - C. Follow your friend and break the tree branches with him
 - D. Not bothered to do anything
18. You see a SMALL forest fire while collecting forest products. What is your FIRST action?
- A. Try to extinguish the fire
 - B. Tell the Tok Batin
 - C. Go back home and tell your parents
 - D. Not bothered to do anything



19. Your home has many items as shown above. What would you do with the items?
- A. Send them to recycling centers
 - B. Dump them into the trash bin
 - C. Burn the items
 - D. Dig a hole and bury the items

20. Your mother prepares packed food for you to bring to school. What type of packaging would you choose?



Paper food container
A

Polystyrene
B

Plastic container
C

newspaper
D

B. Environmental Behavior Attitudes

1. I will learn ways to preserve the environment
2. I will advise others not to spoil the environment
3. I care for the environment as it benefits my health
4. I care for the environment as this gives me the opportunity to enjoy the beauty of nature
5. I am happy to be able to preserve the environment
6. ~~I am sad to see others spoil the environment~~ (The item was dropped due to low validity).

C. Locus of Control

1. I feel that my efforts in saving nature are important.
2. ~~I feel that protecting the environment is an easy thing for me if I want to do it.~~ (The item was dropped due to low validity)
3. I have difficulties in protecting the environment.
4. I feel that my caring for the environment is useless if others do not care about it.
5. I feel that the Earth surviving from human activities depends on God's provision.

D. Personal Responsibility toward the Environment

1. I am responsible for preserving the environment.
2. ~~I feel guilty if I pollute the environment.~~ (The item was dropped due to low validity).
3. I am responsible for reprimanding people who pollute the environment.
4. I am responsible for learning how to reduce environmental problems.
5. I am responsible for practicing what I have learned to protect the environment.

E. Aboriginal people's beliefs about the Environment

1. I believe that forest products should only be harvested for daily needs
2. I believe that forest products cannot be taken without consent.
3. I believe that people who spoil the environment will be punished.
4. I believe that the natural resources should be shared.
5. I believe that the environment is guarded by the "spirit and nature God".

F. Environmental Care Behavior

1. I have planted a tree
2. I have collected forest plants.

3. I have broken tree branches
4. I wore clothes from animal skin.
5. I advised other people not to hurt animals.
6. I helped wounded animals.
7. I used both sides of the page when writing.
8. I sorted waste materials by their type (papers, plastics, glasses).
9. I invited others to join the gotong-royong to clean the residences.
10. I joined the gotong-royong to clean the river.
11. I dumped trash into the river
12. I bathed in the river using soap.
13. I read reading materials related to the environment.
14. I talked to friends about the environment.
15. I watched television channels related to the environment.