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CONSTRUCTION AND VALIDATION OF THE ‘CHILDREN’S CONNECTEDNESS TO NATURE’ INSTRUMENT

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Abstract

Developing a connectedness to nature (CTN) during childhood is important, as it affects children’s attitude and behaviour towards nature in later childhood and adulthood. Hence, it is crucial to measure children’s CTN at an early age. Several instruments have been introduced to measure children’s CTN based on adults’ instruments. However, the conceptualisation of CTN and its underlying constructs among children remain unclear. Previous instruments have measured children’s CTN using various constructs with one or a combination of two or three psychological domains that include the cognitive, affective, and behavioural domains. As scholars have suggested that CTN should be measured using a combination of three domains: thus, this study aims to develop a reliable and valid instrument to measure children’s CTN based on the three domains. Surveys were distributed to 760 children aged 10 and 11 years old in 20 public primary schools (urban and rural areas) in Kedah and Pulau Pinang, Malaysia. Reliability tests and validity analysis indicated that the new developed instrument was reliable and valid to measure children’s CTN. This study has shown that CTN among children should be measured using the cognitive, affective, and behavioural domain. The constructs involved are empathy towards nature, sense of responsibility, enjoyment in nature, dependence on nature, interest in nature activities, and interest in natural spaces. This newly developed instrument can be used to measure children’s CTN at an early age as part of environmental education or green-module programmes in schools. The directions for future research are also discussed.

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Keywords: Children, connectedness to nature, instrument, construction, validation.



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1. Introduction

Studies have shown that an individual's disposition towards nature or connectedness to nature (CTN) plays an important role in developing a positive attitude and behaviour towards the environment as a child now and later as an adult (Cheng & Monroe, 2010; Duerden & Witt, 2010; Zhang, Goodale, & Chen, 2014). CTN has been found to be associated positively with a specific attitude towards nature and landscape (Tang, Sullivan, & Chang, 2014). A recent study has found that people with high CTN plant more trees in their gardens and spend more time there (Lin et al., 2017). Most importantly, retrospective studies have shown that CTN developed in childhood has long-term effects that continue in adulthood. CTN developed in childhood influences environmental career choices, environmental concern, and use of green areas in adulthood (Thompson, Aspinall, & Montarzino, 2007). Hence, it is difficult to ignore the importance of children's CTN, as it affects their attitudes and behaviour towards the environment and nature throughout life. CTN should be nurtured, developed, and measured at an early age, specifically during middle childhood (7 to 12 years old) since children explore the outdoor environment extensively and develop their identity by interacting with natural surroundings at this age (Kellert, 2005).

2. Problem Statement

Scholars have introduced various instruments to measure children's CTN. However, previous instruments have measured CTN in various concepts and constructs that involved three psychological domains that include the cognitive, affective, and behavioural domains. Some researchers have conceptualised and measured CTN in only one domain, while others have used two or three domains (Mustapa, Maliki, Aziz, & Hamzah, 2016). Question arises as to which one is more reliable. Several scholars have suggested that the uni-dimensional approach is limited in its ability to reflect attitudes and behaviour, whereas the multi-dimensional approach is more reliable in measuring CTN, as it performs better to predict behaviour (Restall & Conrad, 2015). These indicate that conceptualization of CTN in only one or two domains may have limitations in reflecting children's CTN. Hence, this study has conceptualized and measured CTN in three psychological domains (cognitive, affective, and behavioural), as suggested by Schultz (2002). Furthermore, several researchers have suggested that people from different cultures respond differently towards nature (Milfont, 2012). Therefore, this study aims to develop a CTN instrument that is valid, reliable and child-friendly, to be used specifically among Malaysian children, based on previous instruments.

2.1. Children's Connectedness to Nature Constructs

There are six potential constructs that can be used to measure children's CTN based on existing adult and children instruments. The constructs are nature awareness, environmental identity, enjoyment in nature, empathy towards nature, interest in nature activities, and interest in natural spaces (Mustapa et al., 2016). These constructs can be categorised under the cognitive, affective, and behavioural domains. Environmental identity and nature awareness are the cognitive domain, enjoyment in nature and empathy towards nature are the affective domain, and interest in nature activities and interest in natural spaces are the behavioural domain.

Nature awareness refers to children's awareness of the importance of nature. Schultz (2000) stated that a person will value, care, respect, and protect the nature if they feel good about the environment. Meanwhile, environmental identity refers to children's belief that they are part of nature. Studies have shown that a positive attitude and behaviour towards nature and the environment indicates that the person has stronger environmental identity. People who include nature as part of his/her concept of her/himself are more likely to act in an eco-friendly manner towards the environment (Schultz, 2000; Clayton, 2003). Empathy towards nature indicates the feelings experienced when seeing people destroy nature. Milfont and Sibley (2012) described that higher CTN can be related to higher levels of empathy towards nature. Enjoyment in nature refer to children's enjoyment of being in nature. Studies have found that people with high CTN have more enjoyment of being in nature (Davis & Gatersleben, 2013; Tang et al., 2014). Interest in nature activities refers to children's inclination to participate in nature activities. People who are connected to nature like to spend more time in nature and do nature activities (Aaron & Witt, 2011; Lin et al., 2017). Interest in natural spaces measures children's interest in being in green areas. A study with adults has shown that those who have higher CTN plant more trees in their gardens (Lin et al., 2017). Similarly, a study with children by Ballantyne and Packer (2002) found that children who have high CTN have more interest in natural areas.

3. Research Questions

- Do cognitive, affective, and behavioural domains reflect children's connectedness to nature?
- Do nature awareness, environmental identity, enjoyment in nature, empathy towards nature, interest in nature activities, and interest in natural spaces constructs reflect children's connectedness to nature?

4. Purpose of the Study

This study aims to develop a reliable and valid instrument to measure children's CTN specifically to be used among Malaysian children.

5. Research Methods

5.1. Instrument development

Nature awareness was measured through five items adapted from Nisbet, Zelenski, and Murphy (2008), Clayton (2003), Larson, Green, and Castleberry (2009), and Cheng and Monroe (2010). An example of an item for this construct is "Nature is important for my life". Environmental identity was constructed using six items adapted from Cheng and Monroe (2010) and Frantz, Mayer, and Sallee (2013). An example of an item for this construct is "I am part of nature". Empathy towards nature was measured using three items adapted from Cheng and Monroe (2010). An example of an item for this construct is "I feel sad seeing forest cleared". Enjoyment in nature was measured using eight items adapted from Cheng and Monroe (2010), Kals, Schumacher, and Montada (1999), and Clayton (2003). An example of an item for this construct is "I feel happy being in natural places such as waterfalls, rivers and beaches". Interest in nature activities was measured using four items adapted from Cheng and Monroe (2010) and Aaron and Witt

(2011). An example of an item for this construct is “I want to learn more about nature”. Interest in natural spaces was measured using six items adapted from Clayton (2003), Aaron and Witt (2011), McAllister, Lewis, and Murphy (2012), and Ballantyne and Packer (2002). An example of an item for this construct is “I prefer to live in a house surrounded with green areas as compared to surrounded with buildings”.

Overall, the first version of the instrument consists of 32 items. Following Cheng and Monroe (2010), this study measured CTN using a five-point Likert scale to indicate levels of agreement, ranging from 1= strongly disagree to 5=strongly agree. Smiley icons were used to indicate their level of agreement. Since the CTN scale is a newly developed instrument based on previous instruments and findings from other studies, a pre-test was conducted to assess the readability and the appropriateness of the language in accordance with children’s language development. As a result, a few items needed to be deleted because some children found it difficult to understand them. The items that need to be deleted were the environmental identity items, which are abstract items that require children to visualise (McDevitt & Ormrod, 2002). No new items were generated and there were 28 items left. Two pilot studies were then conducted. After pilot studies have been conducted, pictures were included for each statement to make it easier for the children to understand the context of this study and the Likert scale was also modified from a five-point to a four-point scale ranging from 1=strongly disagree to 4=strongly agree based on comments from the experts during content validity as well as to avoid the central tendency bias found in pilot study 1.

5.2. Sampling and data collection

The final data collection was conducted between February 2016 and April 2016. The final version of the CTN instrument was distributed to 760 children aged 10 and 11 years old at twenty public primary schools in Kedah and Pulau Pinang, Malaysia. Ten urban schools and ten rural public primary schools were chosen at random. Schools were selected as the site for data collection instead of other places such as neighbourhoods to make it easier to approach children, since this study needs a large sample size and the children are gathered together at school. The sample size was chosen using stratified random sampling. Of the 760 children, 49.9% were aged 10 and 50.1% were 11. Meanwhile, 51.2% were male and 48.8% were female. The majority of the children (97.0%) were Malay, and of the remainder, 1.5% were Indian, 0.5% were Chinese and 0.7% were of other ethnicities (e.g. Siamese). The researchers guided the children to answer the survey by reading the statements aloud one by one.

5.3. Analyses

Data were analysed using IBM SPSS Statistics Version 22. Factor analysis, specifically Exploratory Factor Analysis (EFA), was used to test construct validity. Factor analysis groups inter-correlated items into components or constructs. Then, the researcher needs to name the constructs based on the highest significant loading item. After conducting factor analysis, a reliability test using internal consistency (Cronbach’s Alpha) was performed for each construct.

6. Findings

Measures of sampling adequacy, Kaiser-Meyer-Olkin test and Bartlett’s test of sphericity, were first performed to confirm that factor analysis was appropriate. The value for the Kaiser-Meyer-Olkin test was

0.83 and Bartlett’s test of sphericity was 0.000. Both measures confirmed that factor analysis was suitable. Subsequently, factor analysis was conducted. At first, seven components were derived from the results with eigenvalues greater than 1, explaining 17.91%, 8.12%, 5.96%, 5.18%, 4.68%, 4.24% and 4.03% of the variance respectively. However, one of the components had only two items (items 3 and 4). Also, based on the researchers’ judgement, some of the items did not fall under suitable constructs. Thus, the researchers explored the factor structure with six components and the items fell under suitable constructs. One item (item 15) needed to be deleted because it did not load on any construct (see Table 1). Thus, of the original 28 items, only 27 items remained.

The six components explained a total variance of 46.09%, with component 1 contributing 17.91%, component 2 contributing 8.12%, component 3 contributing 5.95%, component 4 contributing 5.18%, component 5 contributing 4.58% and component 6 contributing 4.24%. The components were named based on the item with the most significant loading. Component 1 was thus named “empathy towards nature”, component 2 was named “sense of responsibility”, component 3 was named “enjoyment in nature”, component 4 was named “dependence on nature”, component 5 was named “interest in natural spaces” and component 6 was named “interest in nature activities”. Environmental identity items did not have the highest loadings on any construct: thus, environmental identity was not one of the constructs to be named. This supports the findings from the pre-test, which indicated that children find it difficult to understand the concept of themselves being part of nature (environmental identity).

Table 01. Rotated factors of CTN

Constructs	Rotated component matrix						
	Items	Factor loading					
		1	2	3	4	5	6
Empathy towards nature	I feel sad when seeing a forest being cleared	0.878					
	I feel sad when seeing nature being destroyed	0.882					
	I feel sad when seeing animals losing their habitat because of deforestation	0.853					
Sense of responsibility	I will take care of nature		0.659				
	I will not destroy nature		0.590				
	I have a close connection with nature		0.465				
	I like to see natural elements such as plants and animals		0.526				
	I want to learn about nature		0.569				
	I want to be involved in gardening		0.519				
Enjoyment in nature	I like to visit natural places that are away from cities			0.660			
	I like to spend more time in natural places			0.662			
	I feel happy in natural places such as waterfalls, rivers, and beaches			0.683			
	I feel fresh in natural places such as waterfalls, rivers, and beaches			0.481			
Nature dependence	Nature is important for my life				0.416		
	I need nature to survive				0.666		
	I am part of nature				0.639		
	My life will change if there is no nature				0.501		

	I prefer to learn in green areas in school rather than in classrooms				0.424		
Interest in natural spaces	I prefer to play in green areas near my house					0.402	
	I prefer to be in a room that has a view of green areas rather than a room with a view of buildings					0.459	
	I want to own a house that has green areas					0.582	
	I would prefer to live in a house surrounded with green areas as compared to surrounded with buildings					0.653	
	I want to live in a peaceful village rather than in a busy city					0.695	
Interest nature activities	I like to be in the forest						0.643
	I want to go camping near natural places						0.413
	I want to hike in natural places						0.567
	I feel scared being in nature alone						0.514
	I like to hear the sounds of nature, such as water flowing, rivers, birds, fowl, and others	Did not fall under any construct					

A reliability test was then conducted for each construct. For component 6 (interest in nature activities), item 18 needed to be deleted to achieve a higher Cronbach's Alpha value. Twenty-six items remained, as listed in Table 2. The Cronbach's alpha values for each construct were acceptable, as they were all 0.6 and above (see Table 2). Even though five of the constructs had the lowest acceptable value, which is 0.6, the inter-correlation values for all items were 0.3 and above. This indicates that the constructs derived and the instrument are reliable (Pallant, 2013). Moreover, this is a newly developed instrument: therefore, its Cronbach's alpha value is acceptable.

Table 02. Reliability result for each constructed of CTN

Construct	No. of Items	Items	Cronbach's Alpha
Empathy towards nature	3	I feel sad when seeing a forest being cleared	0.89
		I feel sad when seeing nature being destroyed	
		I feel sad when seeing animals losing their habitat because of deforestation	
Sense of responsibility	6	I will take care of nature	0.64
		I will not destroy nature	
		I have a close connection with nature	
		I like to see natural elements such as plants and animals	
		I want to learn about nature	
		I want to be involved in gardening	
Enjoyment in nature	4	I like to visit natural places that are away from cities	0.59
		I like to spend more time in natural places	
		I feel happy in natural places such as waterfalls, rivers, and beaches	
		I feel fresh in natural places such as waterfalls, rivers, and beaches	
Nature dependence	5	Nature is important for my life	0.56
		I need nature to survive	
		I am part of nature	

		My life will change if there is no nature	
		I prefer to learn in green areas in school rather than in classrooms	
Interest in natural spaces	5	I prefer to play in green areas near my house	0.58
		I prefer to be in a room that has a view of green areas rather than a room with a view of buildings	
		I want to own a house that has green areas	
		I would prefer to live in a house surrounded with green areas as compared to surrounded with buildings	
		I want to live in a peaceful village rather than in a busy city	
Interest in nature activities	3	I like to be in the forest	0.59
		I want to go camping near natural places	
		I want to hike in natural places	

7. Conclusion

The findings of the present study have revealed that there are six underlying constructs that can be used to measure children's CTN, namely empathy towards nature, sense of responsibility, enjoyment in nature, dependence on nature, interest in natural spaces, and interest in nature activities. Four of the constructs (empathy towards nature, enjoyment in nature, interest in natural spaces, and interest in nature activities) are similar to those found in previous studies examined in the literature review. However, two of the constructs were named differently according to the highest loading items. These two constructs were named as nature dependence and sense of responsibility. Sense of responsibility refers to children's beliefs about taking care of nature, whereas nature dependence refers to children's beliefs about their dependency on nature. Although two of the constructs (nature dependence and sense of responsibility) were named differently from previous studies, these findings support previous studies that suggested that CTN can be measured through nature awareness (dependence on nature and sense of responsibility), empathy towards nature, enjoyment in nature, interest in natural spaces and interest in nature activities.

Interestingly, environmental identity items do not have the highest loading: therefore, environmental identity is not one of the constructs to be named in this study. This finding indicates that children did not see themselves as part of nature and had difficulty understanding the abstract ideas in the environmental identity construct. This can be explained by the fact that children at middle childhood age are in the concrete operational stage and find it difficult to understand abstract ideas, and they comprehend nature in a direct manner in terms of what they see. Hence, it can be concluded that CTN among children needs to be measured using direct statements that can be understood by the children and at the same time reflect their CTN. Another possible explanation for this finding might be related to cultural differences, as people from different cultures response differently towards nature (Milfont, 2012).

These findings further confirm that CTN can be conceptualised as a disposition towards nature that can be measured using three psychological domains, namely the cognitive, affective, and behavioural (Schultz, 2002). The findings also support the contention that children's CTN should be measured using a multi-dimensional approach. These findings corroborate the ideas of Restall and Conrad (2015), who suggested that a multi-dimensional approach is more reliable when measuring CTN. Measuring children's CTN in only one domain leads to limitations in understanding children's CTN. This newly developed instrument has combined all three domains and the findings suggest that it is a reliable instrument that can

be used to measure CTN among children, as the Cronbach's Alpha values for each construct were acceptable.

In conclusion, this study provides several insights on the conceptualization and measurement of children's CTN. First, it adds to a growing body of literature on the constructs underlying children's CTN. Second, it extends the knowledge that CTN should be measured through three psychological domains: cognitive, affective and behavioural. Third, this study has made an important contribution to the development of a CTN instrument that is reliable and psychometrically sound to be used among children. This CTN instrument helps practitioners in the educational field to measure children's CTN at an early age. Future research should test this instrument using a Likert scale with different points as it might increase the reliability of this instrument, as well as employed Confirmatory Factor Analysis (CFA) to validate the constructs. Finally, further exploration using qualitative approach would be an advantage to validate the constructs of this instrument.

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