

# DEVELOPMENT OF ENVIRONMENTAL AWARENESS MEASUREMENT INSTRUMENTS THROUGH EDUCATION FOR SUSTAINABLE DEVELOPMENT

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**Abstract** - This article aims to develop the environmental awareness measurement instruments through Education for Sustainable Development among secondary school student in Malaysia. Confirmatory Factor Analysis (CFA) were used to test the validity and reliability of the instrument. A total of 1,180 Form 4 students were involved in this research. A stratified sampling technique was selected to determine the location of schools in urban and rural areas while the selection of respondents using a simple random sampling technique. Feedback was attained by using a questionnaire with a five-point Likert scale. Data were analysed descriptively for reliability (Cronbach's alpha values) and Exploratory Factor Analysis (EFA) was done after the data were obtained for deleting unnecessary items. The overall data were analysed using Confirmatory Factor Analysis (CFA) for items grouping. The results showed that there was a relationship between knowledge construct with attitudes, practices, values, and behaviour. The reliability value obtained was more than 0.70. The study implies that the instrument produced could become an important tool in assessing environmental awareness through ESD practices among secondary school students in Malaysia.

**Keywords:** environmental awareness, exploratory factor analysis (EFA), confirmatory factor analysis (CFA), secondary school students.

## I. Introduction

Society and the environment are interrelated. However, humans rampantly exploit the environment to improve their quality of life, and, in doing so, interrupt the natural balance, ultimately triggering all sorts of serious environmental problems (Gulgul, Onder, Aktas, & Unal Ankaya, 2008). Various environmental problems, such as global warming, deforestation, inefficient energy use, and pollution get global and international attention as a result of the technological progress and industrial development that have been achieved in recent decades (Burkin, Umut, Yasemin, Nilay, & Duygu, 2015; Gulcan & Seda Hilal, 2010).

The growing number of environmental disasters each day has raised awareness of the importance of preserving and conserving the environment (Darryn, Hartmut, & Karyn, 2013; Jennifer, Waliczek, & Zajicek, 1999). Aspects of sustainable development were first highlighted in 1987 by the Brundtland Report (World Commission on Environment and

Development, 1987), to ensure that the present development will not affect the environmental capability for future generations. The emphasis on environmental care are required to create an environmentally literate society. People need to be exposed on the impact of pollution to all living beings in order to promote environmental awareness (Haliza, 2010; Kimani, 2007). Society should protect and preserve the environment by increasing the level of awareness, especially among students, which are an important asset in the continuing effort to preserve the environment (Babita, 2015). The importance of instilling awareness in the context of education for sustainable development (ESD) needs to be emphasised, as students play a role in creating a sustainable environment (Hanifah, Shaharuddin, Mohamad Suhaily Yusry, & Noraziah, 2014).

The ESD approach been seen as one of the effective strategies for increasing the level of environmental awareness and instilling natural feelings among students and the community (Hacer, 2009). ESD has the potential to produce a new environmentally literate generation in term of knowledge, attitudes, values, practices and skills (Pedro, Mercedes, & Alvarez-Suarez, 2015). Most countries have accepted the concept of sustainable schools as a policy objective and the principles of ESD have implemented through programmes such as in Australia (Sustainable School (AuSSI)), New Zealand (Enviroschools), Sweden (Schools Award), China (Green Schools Project) and United Kingdom (Eco School) (Kalaitzidis, 2012). In Malaysia, ESD become a cross-curricular subject that have been applied to many subject for the purpose of fostering a love to the environment. The establishment of the Sustainable School Environmental Award (SLAAS) is also one of the approach used in Malaysia to integrate sustainability into every aspect of life in terms of water consumption and electricity saving (Hanifah, Mohamad Suhaily Yusri, & Shaharudin, 2012).

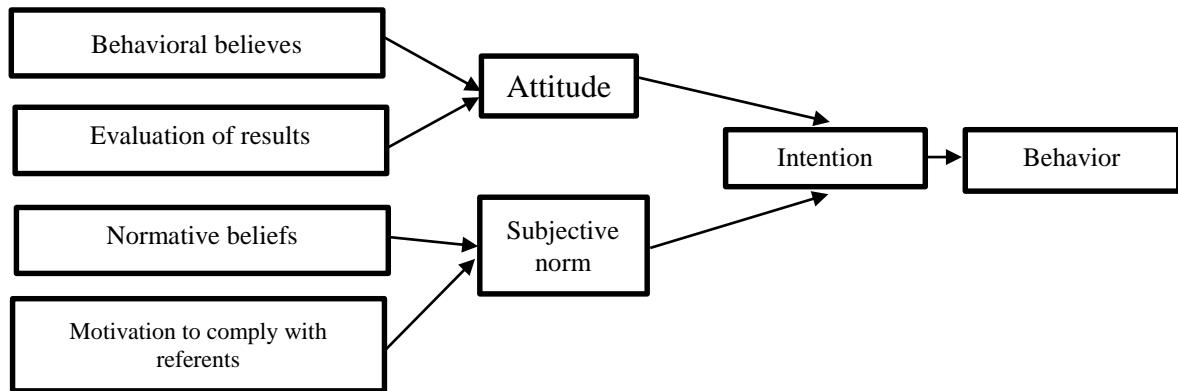
Efforts in creating environmentally literate generation is a requirement in creating a generation that is more sensitive to the environment or working to preserve the environment. This clearly proves that knowledge are interrelated with attitudes (Gisela & Merce 2015; Hanifah, Muhammad Suhaily Yusri, & Shaharuddin, 2013). High level of knowledge is able to

improve people's attitudes towards the environment (Mohammad Ohid, Md Abu, & Taj, 2013). The teacher's role is also very important in providing knowledge to students in order to change the future of the environment by becoming more sustainable (Neil, Tamar, Kathy, & Julie, 2007).

Therefore, ESD is the most influential medium in achieving the objectives of sustainable development and raising the awareness in dealing with environmental issues. Thus, development of suitable instruments is seen as a requirement for assessing environmental awareness in the context of ESD especially among students in Malaysia.

### **Knowledge, Attitude, Value, Practice and Skills Create Environmental Literacy**

Application of knowledge, attitudes, values, practices, and skills are seen as key components that help create an environmentally literate generation. Therefore, this study takes into account the variables of knowledge, attitudes, values, practices, and skills to assess the environmental awareness among secondary-school students. There are several theories and models used as a base in the selection of the variables in this study. The theory of reasoned action (TRA), introduced by Ajzen and Fishbein (1975), which is a general theory for predicting behaviour. This theory states that behaviour can be predicted by the intention to act, where the intent is determined by the attitude towards the behaviour and subjective norms. This theory also explains that the intention has to be encouraged by a good attitude in order to encourage positive behaviour. Thus, one's intention is very important in influencing behaviour (Figure 1).

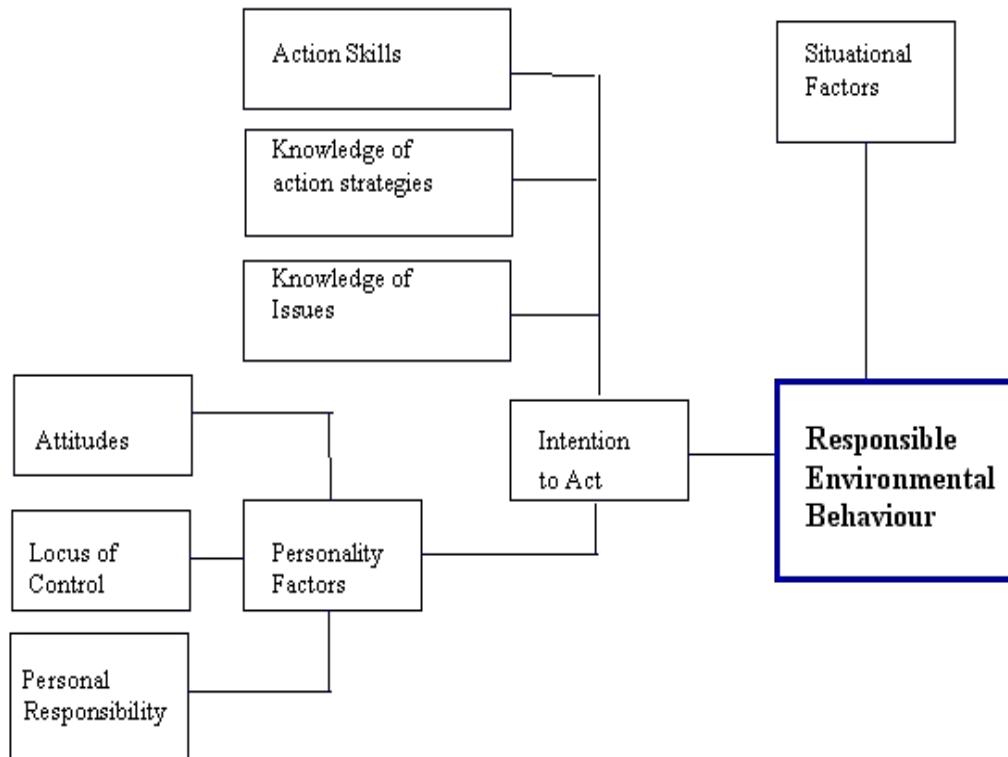


**Figure1** Theory of Reasoned Action (TRA)  
Source: Ajzen and Fishbein (1975)

Next is the Theory of Planned Action (TP), by Ajzen and Fishbein (1980), which explains that the proposed behaviour is influenced by attitudes, subjective norms, and behaviour control. The three main factors are interrelated and used to predict and explain the behaviour proposed by an individual. This theory is included in this study with an emphasis on the formation of attitudes that can lead to behaviour change.

In addition, the Responsible Behaviour Model (Hines, Hungerford, & Tomera, 1986/87) is also used as a basis for this discussion. The model divides the components of environmental responsibility into three personal factors, namely an personality factor, which is related to an individual internal aspect (attitude, locus of control, personal responsibility); intention of act, which is related with knowledge and skills (knowledge, action skills); and a situational factor, which is

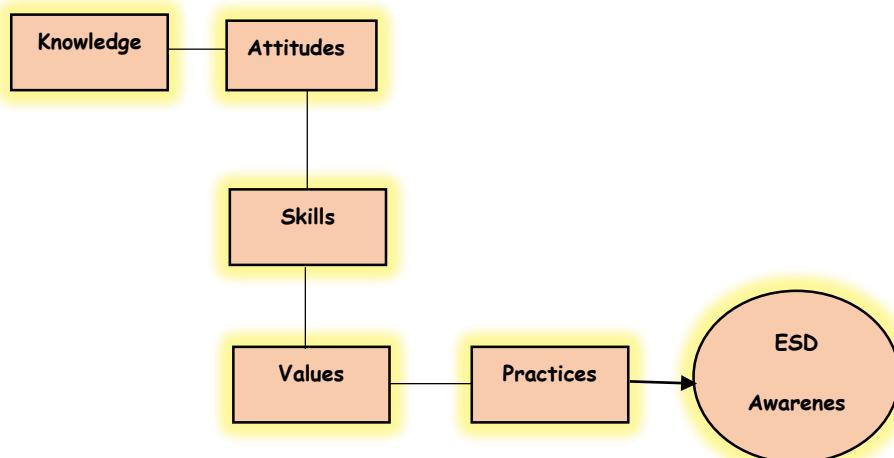
associated with the surrounding conditions (Figure 2). This model suggests that behaviour is influenced by the personal and knowledge components. When the personal and knowledge components about the environment are high, this may affect the action towards the environment. This model can predict a person's behaviour to become more environmentally responsible. A study by Julie, Nathaniel, and Thomas (2015) also used this model for predicting environmental behaviour consisting of variables (environmental attitude, the locus of the area, a sense of personal responsibility, intention) for predicting the behaviour of students. The results showed that the change in the level of environmental attitudes that predict environmental action is linked with environmental action. Positive changes in attitude have contributed to changes in environmental behaviour among students



**Figure 2** Responsible Behaviour Model  
 Source: Hines, Hungerford, & Tomera (1986/87)

However, this study did a little modification on the selected theory, in line with the objectives of the study (Figure 3). This study explores the relationship between the ESD awareness of the students, which is the dependent variable, and their knowledge, attitudes, values, practices, and skills, as independent variables.

According to Figure 3, the exogenous latent variables (independent variables) are knowledge, attitudes, practices, values, and skills. Meanwhile, the endogenous latent variable (the dependent variable) is ESD awareness.



**Figure 3** Conceptual Framework of the Study

Knowledge is the key variable in the conceptual framework. Environmental knowledge refers to knowledge of ecology, of natural history, of environmental issues, and of socio-political and economic issues (Mehmet, 2009). According to Fryxall

and Lo (2003), environmental knowledge is defined as a general knowledge of the facts, concepts, and relationships about the natural environment and ecosystems. In addition, knowledge of the environment is defined as the ability to understand and assess the

impact of society on the ecosystem (Gambro & Switzky, 1994; Jan & Susan, 2011; Mark, 2012). Apart from that, an attitudes variable is also included in the above conceptual framework. The attitudes variable consists of cognitive, affective, and psychomotor elements (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956; Stephen, 1995). According to Allport (1935), attitude refers to the state of mental readiness to conduct a direct influence on the individual response to all related objects and situations. There are several theories regarding changes in attitude and theories associated with environmental education, as environmental education has the potential to change behaviour.

An element relating to environmental concerns is also included in the attitude variable. Environmental concerns refer to an individual's emotional characteristics, such as like or dislike, consideration concerns (Mohammad Zohir & Nordin, 2007; Yeung, 1998), beliefs, attitudes, and levels of concern (Aini, Fakhrul-Razi, Laily, & Jariah, 2003) towards the environment. Thus, environmentally concerned individuals are those who are sensitive to issues concerning the environment. According to UNESCO (1977), environmental attitude refers to the set of values and feelings of concern for the environment and the motivation to actively participate in environmental improvement and protection.

Additionally, behaviour/practice variables are also found in this study. Kollmuss and Agyeman (2002) suggest that environmental behaviour is any behaviour that occurs consciously and aims to reduce the negative impact on the real world. Environmental behaviour can be divided into four types. The first type refers to activists who are committed and actively involved in any activities related to the environment for the purpose of supporting public policies that can affect the environment. The second type of behaviour is that of a non-activist individual or community that supports public policies and provides financial support to organisations that affect environmental preservation. Both types of behaviour indirectly affect the preservation of the environment. The third type of behaviour is the involvement of individuals who influence others towards the environment by influencing the actions of the organisation that they

own. Next, the fourth type of behaviour is more of a personal kind of behaviour of individuals, which includes methods of buying, consuming, and disposing of personal and household goods that affect the environment.

Therefore, the result of the identification of variables has led to the construction of instruments for measuring environmental awareness in the context of ESD. The instrument is based on a number of related theories and models to create items which are in line with the issues and the environment in Malaysia.

## **II. Methodology**

Quantitative approach where used to conducted the research in this study. A total of 1,180 Form 4 students were involved in this research. A stratified sampling technique was selected to determine the location of schools in urban and rural areas while the selection of respondents using a simple random sampling technique. Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were used to explore and verify ESD instruments.

### **Source of Data and Study Area**

The data were obtained from a field study that was conducted in 2016. The study involved 24 schools in Malaysia (Figure 4). Stratified sampling technique was used to select school samples that dividing into two, urban and rural areas. The fixing of the states in Malaysia was set based on zones to facilitate data collection (Table 1). Each zone represented by four schools consisting of urban and rural areas.

Meanwhile, the simple random sampling technique was used to select a sample of students of 1180 respondents. Samples were selected from among students aged 16 years old. The selection was justified based on the basic knowledge of the students regarding the environment. A pilot study was first conducted on 100 respondents to modify the items of the questionnaire so that it would be able to achieve the goals of the study. A total of 1150 questionnaires were able to be used after a data cleaning test was conducted.

**Table 1** Number of Secondary School Samples in Malaysia

<b>Zone</b>	<b>Numbers of School Sampel</b>	
	<b>Urban</b>	<b>Rural</b>
Northern	113	107
Central	102	103
Southern	117	105
Eastern	118	120
East Coastal	187	108
<b>Total</b>	<b>637</b>	<b>543</b>

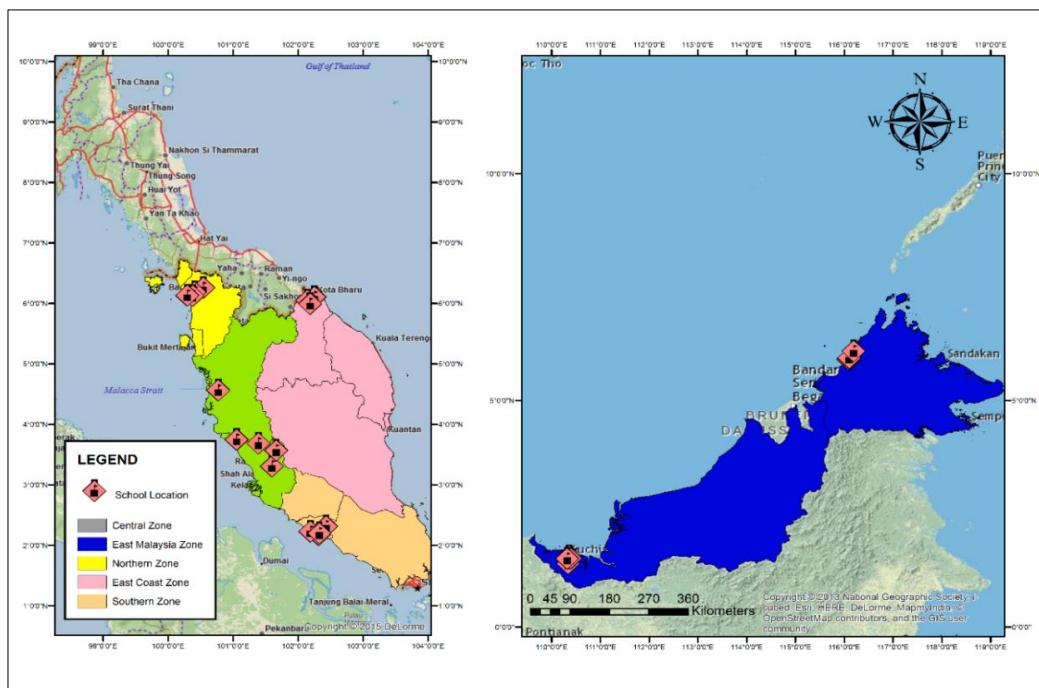


Figure 4 Study Area

### III. Instrument

The environmental instrument was developed to assess students' awareness in the context of ESD. Before the instrument was developed, a literature review was conducted to examine the component in the field of ESD and environmental awareness. Two experts in the field of geography and the environment and two experts in measurement and evaluation instruments were recruited to get information and ensure that the literature review adequately covered the relevant fields. The identification of the variables was also reviewed in order to produce a high quality instrument. As a result of discussions and studies conducted, a total of 180 items were developed. The validity of the items was assessed to ensure that the items meets the objectives of the study. In this second stage, a number of experts from among the lecturers at Universiti Kebangsaan Malaysia (UKM) and Universiti Pendidikan Sultan Idris (UPSI) were appointed to verify the validity of items in terms of content, clarity, understanding, and accuracy. The experts were asked to examine the items to ensure that they were consistent and easily understandable, as well as being compatible with the purposes and content of the study. After the review was carried out, a number of items were dropped, as they diverged from the scope of the study. As a result, a total of 100 items were developed to carry out a pilot study.

Items that had been modified based on expert opinions were used in the pilot study. The sample used in the pilot study consisted of 100 students. Data obtained from the pilot study were ran through Exploratory Factor Analysis (EFA) to obtain the instrument structure factor of environmental awareness through ESD. The final draft of environmental awareness instrument through ESD was distributed to

the actual study sample to assess the validity (construct validity) and reliability of the instrument. The actual study sample consisted of 1180 respondents (449 male, 731 female). Data were obtained from 1180 students from all over Malaysia which were divided into several zones. Data were analysed by using factor analysis and reliability analysis to get Cronbach alpha values. The purpose of the CFA is to compare the findings to the structural factors / new constructs emerging from the EFA process and to verify the factor structure and environmental awareness instrument through ESD.

### IV. Results

The results of this study are explained and discussed based on two aspect, environmental awareness instrument structure factor, environmental awareness dimensional construct, factor validity analysis: cross-validating initial factor structure, reliability coefficients and final version of instrument.

### **Environmental Awareness Instrument Structure Factor**

Exploratory Factor Analysis (EFA) was conducted to obtain the initial structure of the underlying instrument to measure environmental awareness through ESD which consisted of 150 items. Varimax rotation method and principal component analysis (PCA) were used to determine the structure contained in the factor scale. Data that were appropriate for factor analysis were tested by using the Keiser-Mayer-Olkin (KMO) coefficient and Barlett Sphericity Test. KMO values obtained were mostly 0.9 and acceptable in the factor analysis. In addition, the acceptable measurement for assessing the strength of the relationship between variables is the value of Barlett's test of Sphericity. This study found that the level of significance was  $p < 0.001$ . This proves that the relationship that existed between the variables is strong.

The results of the EFA found that the instruments formed had been extracted into five main factors, namely knowledge, attitude, practice, value and skills. As for the knowledge factor, there are three main components of sub-factor in the knowledge factor. Scree plot shows that three factors declined sharply and then stayed constant. This indicates that the varimax rotation needs to be done for the three factors.

The EFA results on the knowledge measuring tool of education for sustainable development content explains that the anti image correlation analysis procedure shows the correlation coefficient value is more than 0.5, and this gives the impression that the factor analysis can be continued. The adequacy of KMO is 0.936, while the Barlett Sphericity test is significant with 23251.850 chi-Square at 190 degrees of freedom.

**Table 2** Suitability Test on the Use of Analysis Factor and KMO Item and Bartlett's Test Uniformity Towards Environmental Attitude Variable

<i>Kaiser-Meyer-Olkin</i>	<i>Measure of Sampling Adequacy</i>	
<i>Bartlett's Test of Sphericity</i>	<i>Approx. Chi-Square Sphericity</i>	23251.850
	<i>df</i>	1326
	<i>Sig.</i>	.000

The EFA results on environmental attitude measuring tool explains the anti image correlation analysis procedure shows the correlation coefficient value is more than 0.5, and this gives the impression that the factor analysis can be continued. The KMO

adequacy measurement is 0.918, while Bartlett Sphericity test was significant with 9973.940 chi-square at 231 degrees of freedom.

**Table 3** Suitability Test on the Use of Analysis Factor and KMO Item and Bartlett's Test Uniformity Towards Environmental Knowledge Variable

<i>Kaiser-Meyer-Olkin</i>	<i>Measure of Sampling Adequacy</i>	
<i>Bartlett's Test of Sphericity</i>	<i>Approx. Chi-Square Sphericity</i>	9973.940
	<i>df</i>	231
	<i>Sig.</i>	.000

The EFA results on knowledge measurement tool of environmental education explains that the anti image correlation analysis procedure shows that the correlation coefficient is more than 0.5, and this gives

the impression that factor analysis can be continued. The KMO adequacy measurement is 0.951, while the Barlett Sphericity test is significant with 35048.239 chi-square at 1711 degrees of freedom

**Table 4** Suitability Test on the Use of Analysis Factor and KMO Item and Bartlett's Test Uniformity Towards Environmental Practice Variable

<b>Kaiser-Meyer-Olkin</b>	<b>Measure of Sampling Adequacy</b>	0.951
<i>Bartlett's Test of Sphericity</i>	<i>Approx. Chi-Square Sphericity</i>	35048.239
df		1711
Sig.		.000

The EFA results on knowledge measurement tool of environmental health explains that the anti image correlation analysis procedure shows that the correlation coefficient value is more than 0.5, and this

gives the impression that factor analysis can be continued. The KMO adequacy measurement is 0.941, while the Barlett Sphericity test is significant with 13127.452 chi-square at 276 degrees of freedom.

**Table 5** Suitability Test on the Use of Analysis Factor and KMO Item and Bartlett's Test Uniformity Towards Environmental Value Variable

<b>Kaiser-Meyer-Olkin</b>	<b>Measure of Sampling Adequacy</b>	0.941
<i>Bartlett's Test of Sphericity</i>	<i>Approx. Chi-Square Sphericity</i>	13127.452
df		276
Sig.		.000

The EFA results on knowledge measurement tool of saving practice explains that the anti image correlation analysis procedure describes shows that the correlation coefficient value is more than 0.5, and this

gives the impression that factor analysis can be continued. The KMO adequacy measurement is 0.918, while the Barlett Sphericity test is significant with 9133.158 chi-square at 210 degrees of freedom

**Table 6** Suitability Test on the Use of Analysis Factor and KMO Item and Bartlett's Test Uniformity Towards Environmental Skills Variable

<b>Kaiser-Meyer-Olkin</b>	<b>Measure of Sampling Adequacy</b>	<b>0.918</b>
<i>Bartlett's Test of Sphericity</i>	<i>Approx. Chi-Square Sphericity</i>	9133.158
df		210
Sig.		.000

### Environmental Awareness Dimensional Construct

Based on the data that have been obtained from factor analysis, it shows that Environmental Awareness Measuring Instrument in the Context of Education for Sustainable Development been grouped into five main sub-factors. When the grouping process is performed, there are several key factors contained in knowledge factor such as the content knowledge of ESD, environmental health knowledge and environmental

education knowledge. As for attitude, the sub-factors are solid waste management and concern for the environment. In addition, the value factor contains two main sub-factors, namely knowledge value and attitude value, and practice factor contains sub-factors such as electricity saving practice, practice of consuming environmentally friendly products. Finally, skills factor contains sub-factors such as creativity skill, reuse skill and green products purchasing skill.

**Table 7** Component Matrix with Rotated Varimax for Environmental Knowledge Construct

Item	Component		
	Content Knowledge of ESD	Environmental Education Knowledge	Health Knowledge
C3.1	.592		
C3.2	.540		
C3.3	.530		
C3.4	.501		
C3.5	.554		
C3.6	.568		
C3.7	.594		
C3.8	.529		
C1.3		.571	
C1.7		.702	
C1.9		.600	
C1.10		.568	
C1.12		.597	
C4.3			.565
C4.4			.646
C4.6			.502
C4.7			.501

**Table 8** Component Matrix with Rotated Varimax for Environmental Attitudes

Item	Component	
	Solid Waste Management Attitudes	Concern For The Environment
D2.1	.667	
D2.2	.687	
D2.3	.688	
D2.4	.600	
D2.5	.562	
D2.8	.603	
D2.9	.718	
D2.10	.595	
D1.1		.558
D1.2		.611
D1.4		.600
D1.5		.742
D1.6		.749
D1.7		.676
D1.8		.677

**Table 9** Component Matrix with Rotated Varimax for Environmental Practice

Item	Component		
	Sustainable Consumption Practice	Electricity Saving Practice	Consuming Environmentally Friendly Products
E2.1	.684		
E2.2	.722		
E2.3	.638		
E2.4	.545		
E2.5	.528		
E2.6	.559		
E2.8	.513		
E2.9	.650		
E2.10	.649		
E2.11	.657		
E3b1		.651	
E3b2		.612	
E3b5		.627	
E3b6		.572	
E3b7		.637	
E3b8		.543	
E3e1			.684
E3e2			.767
E3e3			.709
E3e4			.621
E3e5			.540
E3e6			.525
E3e7			.557
E3e8			.586

**Table 10** Component Matrix with Rotated Varimax for Environmental Value

Item	Component	
	Knowledge Value	Attitudes Value
F1.1	.662	
F1.2	.720	
F1.3	.753	
F1.4	.691	
F1.5	.747	
F1.6	.631	
F1.7	.707	
F1.8	.594	
F2.1		.503
F2.2		.591
F2.3		.554
F2.4		.649
F2.5		.702
F2.6		.626
F2.7		.632
F2.8		.613

**Table 11** Component Matrix with Rotated Varimax for Environmental Skills

Item	Component		
	Creativity Skill	Green Product Purchasing Skill	Reuse Skill
G2.1	.579		
G2.2	.655		
G2.6	.640		
G2.7	.598		
G2.8	.713		
G3.1		.502	
G3.2		.581	
G3.3		.707	
G3.4		.665	
G3.5		.660	
G1.5			.698
G1.6			.740
G1.7			.772
G1.8			.561

#### **Factor Validity Analysis: Cross-Validating Initial Factor Structure**

CFA analysis was ran on the data by using software (AMOS.20) in determining the structural factors that have been factored into the EFA by using survey data.

Tests on the suitability of the model in this study is based on the criteria of Goodness of Fit. Here are some of conformity index and cut off value for testing the acceptance and rejection of a certain model. The measured Goodness of Fit index values are summarised as in Table 12 below.

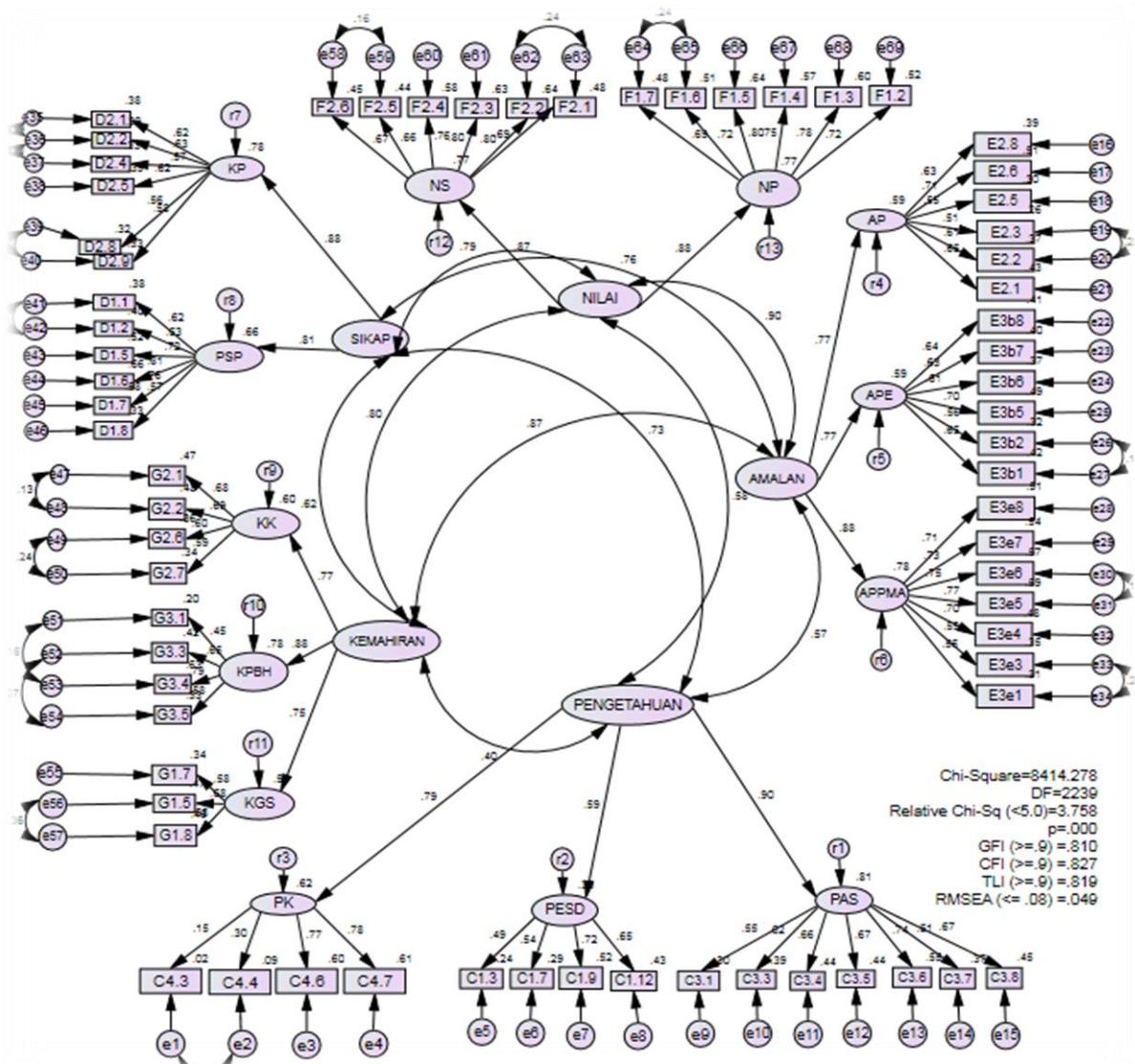
**Table 12** Goodness of Fit Model Testing Index

No.	Goodness of Fit Index	Cut off Value
1.	Chi- Square	>0.05
2.	RMSEA	<0.08
3.	CMIN/DF	>3.0
4.	GFI	>0.90
5.	TLI	>0.90
6.	CFI	>0.90

Source: Schumacker dan Lomax (2004), Hair et al. (2010) and Garson (2012a)

The purpose of SEM was to clarify the relationship between several variables and combine two model characteristics which are measurement model (CFA) and Structural Model into statistical test which was performed simultaneously (Norazah, 2013). Thus, the use of SEM in this study was intended to evaluate the

relationship between variables and verify the path of the establishment of awareness in the context of ESD among students. Therefore Figure 5 show the standard coefficient for the five-factor CAS model based on CFA through AMOS 21.0 that follow the Goodness of Fit index values.



**Figure 5** The standard coefficient for the five-factor CAS model based on CFA

### Reliability Coefficients

Reliability coefficient was used to assess the consistency of the items that were built. Cronbach alpha values were reviewed to ensure that the items were actually measuring what supposed to be measured. Results of the CFA found that several factors had been managed to be produced and a review on the Cronbach alpha values needed to be performed by using SPSS 22.0 software. Knowledge factor which

is the first factor with three items having the reliability value of 0.817. Meanwhile, the attitude factor that consists of two items with Cronbach alpha value of 0.785 and the practice factor that has two items with reliability of 0.896. In addition, the value factor that also has two items gained a reliability value of 0.917 and the skills factor has two items with a Cronbach alpha value of 0.821. Cronbach alpha value for each factor is summarised in Table 13 below.

**Table 13** Reliability of Item

Section	Variables	Number of Items	Alpha Cronbach value
B	Knowledge	15	0.817
C	Attitudes	9	0.785
D	Practices	19	0.896
E	Values	12	0.917
F	Skills	11	0.821

### **Final Version of Instrument**

As a result of the research conducted, the measurement instrument of environmental awareness through ESD is shown in the table 4.14 below.

**Table 14** Final Version of Instrument

Sec.	Description	No Item	Number of items	
C1	Content Knowledge Of ESD	Basic knowledge related to ESD Knowledge regarding ESD dimensions (social, economic & environmental)	3,7, 9,12	4
C3	Environmental Education Knowledge	Knowledge Regarding The Application Of Environmental Education	1,3,4,5,6,7,8	7
C4	Environmental Health Knowledge	Basic Knowledge Is Relevant To Environmental And Human Health	3,4,6,7	4
D1	Solid Waste Management	Attitude In Managing Residual Individuals Or Society	1,2,5,6,7,8	6
D2	Concern For The Environment	Environmentally Sensitive Attitude	1,2,4,5,8,9	6
E2	Sustainable Consumption Practice	Practices Pertaining To Potentially Unfavorable Aspects Of The Environment	1,2,3,5,6,8	6
E3	Electricity Saving Practice	Practicing Electricity Consumption At School And At Home	1,2,5,6,7,8	6
F1	Knowledge Value	Knowledge of Environmental Value	2,3,4,5,6,7	6
F2	Attitude Value	Environmental Impact Assessment	1,2,3,4,5,6	6
G1	Reuse Skill	Skills In Reusing The Used Products	6,7,8	3
G2	Creativity Skill	Skills In Create New Products	1,2,6,7	4
G3	Green Products Purchasing Skill	Skills In Action & Decision Making	1,3,4,5	4
<b>Total</b>			<b>82</b>	

### **V. Discussion**

The development and assessment of the instrument involved five stages, literature review, assessment of the validity of the study items, a pilot study, pilot test of the instrument in an actual study, and assessment of the obtained validity and reliability. Based on the findings, the instrument consisted of five main dimensions, knowledge, attitudes, values, practices, and skills that was measured by five-point Likert scales (1-strongly disagree, 2-disagree, 3-somewhat agree, 4-agree, 5-strongly agree).

The construct validity of this instrument was also measured by using factor analysis and varimax rotation. The results of the factor analysis suggested that the knowledge construct can be divided into several sub-constructs; ESD content knowledge, environmental education, and health knowledge. The attitudes construct is divided into two sub-constructs;

environmental concern attitude and solid waste management attitude. As for the practice construct, this is divided into several constructs, which include spending practice and saving practice. Next, the value construct is divided into two sub-constructs; attitude value and knowledge value, and, finally, the skills divided into three sub construct; re-use skills, creativity skills, and green product purchasing skills. All of the extracted sub-constructs were based on a loading factor value that exceeded 0.50.

In addition, the CFA results found that the standard coefficient for the five-factor achieve fit indices. Based on the goodness of fit (GOF) value, the index value was found to be GFI = 0.801, CF1 = 0.827, TLI = 0.819, RMSEA = 0.049, which proves that there is a relationship between the five factors. Next, the Cronbach Alpha coefficients were also measured for the five factors. The results of reliability analysis found the Cronbach's alpha values above 0.7. This shows that

the instrument is consistent and reliable for predicting environmental awareness among students. The hypothesis that states that knowledge, attitudes, values, practices, and skills are related in creating awareness is accepted in this study, in line with the findings by Arba'at, Norshariani, and Sharifah Intan Sharina (2012), who found that knowledge had a significant relationship with environmental awareness. However, these findings differ from those of Jamilah, Shuhaida, and Nurzali (2015), who found that knowledge does not necessarily lead to good behaviour towards the environment.

Educating students is crucial to producing a generation that is able to preserve the environment. These efforts have to begin by instilling knowledge and awareness in shaping positive behaviour towards the environment. Thus, the instrument produced will encourage school institutions to create a generation with a high level of environmental literacy, in addition to strengthening the effectiveness of education in transforming their attitudes to creating a sustainable future.

## VI. Conclusion

The fit indices value managed to prove that the five constructs are interconnected. The construction of this instrument has the potential for assessing environmental awareness in the context of ESD among students in Malaysia. Establishment of an environmental awareness model in the context of ESD is needed for future research as a support for creating awareness among students. Application of knowledge, attitudes, values, practices, and skills of the student is required to produce an environmentally literate generation. Therefore, the capability of ESD as an agent of change is seen as very important for instilling love for the environment within students.

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## References

- [1] Aini, M. S., Fakhrul-Razi, A., Laily, H. P., & Jariah, M. (2003). Environmental concerns, knowledge and practices gap among Malaysian teachers. *International Journal of Sustainability*, 4(4), 305–312.
- [2] Allport, G. W. (1935). Attitudes. In handbook of social psychology. (C. Murchison, Ed.). Worcester, MA: Clark Univ. Press.
- [3] Arba'at, H., Norshariani, A. R., & Sharifah Intan Sharina, S. A. (2012). The level of environmental knowledge, awareness, attitudes and practices among UKM students. In *Procedia Social and Behavioral Sciences* (pp. 1276–1280).
- [4] Aslina, I., & Haliza, A. R. (2015). Pengetahuan dan amalan pengurusan sisa pepejal dalam kalangan masyarakat di Taman Mesra dan Taman Bakti Kota Bharu, Kelantan. *Jurnal Geografi*, 3(2), 14–27.
- [5] Babita, S. (2015). Society awareness as a strategy for conservation of natural resources. *Social Issues and Environmental Problems*, 3(9), 2394–3629.
- [6] Burkin, D., Umut, A., Yasemin, Eo.-Y., Nilay, Eo., & Duygu, S. (2015). A model for pre-service teachers' climate change awareness and willingness to act for pro-climate change friendly behavior: adaptation of awareness to climate change questionnaire. *International Research in Geographical and Environmental Education*, 24(3), 184–200.
- [7] Daryn, M., Hartmut, F., & Karyn, B. (2013). Resilience and climate change adaptation: The importance of framing. *Planning Practice & Research*, 28(3), 280–293.
- [8] Fryxall, G., & Lo, C. (2003). The influence on environmental knowledge and values on managerial behaviours on behalf of the environment: An empirical examination of managers in China. *Journal of Business Ethics*, 46(1), 45–59.
- [9] Gambro, J. S., & Switzky, H. N. (1994). A National survey of environmental knowledge in high school students: Levels of knowledge and related variables. In *American Educational Research* (pp. 2–42).
- [10] Gisela, C., & Merce, J. (2015). Competencies in Education for Sustainable Development: Exploring the Student Teachers' Views. *Journal Sustainability*, 7(1), 2768–2786.
- [11] Gulcan, C., & Seda Hilal, N. (2010). Enhancing students' environmental awareness. In *Procedia Social and Behavioral Sciences* (pp. 1830–1834).
- [12] Gulgul, B., Onder, S., Aktas, E., & Unal Ankara, F. (2008). Responses of University students related to environmental problems: A case study of Ege University (Izmir-Turkey). *Journal International Environmental Application & Science*, 3(4), 234–246.
- [13] Hacer, T. (2009). Increasing women's environmental awareness through education. In *Procedia Social and Behavioral Sciences* (pp. 939–942).
- [14] Haliza, A. R. (2010). Penglibatan masyarakat peribumi dalam isu berkaitan persekitaran: Tinjauan terhadap suku kaum Mah Meri di Pulau Carey, Kuala Langat, Selangor. *Jurnal Kemanusiaan*, 17(1), 111–134.
- [15] Hanifah, M., Mohamad Suhail Yusri, C. N., & Shaharuddin, I. (2012). Kesedaran Pendidikan Pembangunan Lestari menerusi Program Sekolah Lestari dalam Kalangan Pelajar Sekolah di Malaysia. *Jurnal Geografi*, 1(2), 46–60.
- [16] Hanifah, M., Muhammad Suhaily Yusri, C. N., & Shaharuddin, I. (2013). Satu kajian pentingnya pengetahuan guru dalam pelaksanaan program Sekolah Lestari di Malaysia. *Jurnal Perspektif*, 5(2), 75–92.
- [17] Hanifah, M., Shaharuddin, A., Mohamad Suhaily Yusry, C. N., & Noraziah, A. (2014). Pendidikan Pembangunan Lestari - Hubungan kesedaran antara ibu bapa dengan pelajar. *Jurnal Geografia*, 5(10), 71–84.
- [18] Hanifah, M., Shaharuddin, I., Mohamadisa, H., Nasir, N., & Yazid, S. (2015). Transforming sustainability development education in malaysian schools through greening activities. *Journal Rigeo*, 5(1), 78–94.
- [19] Hanifah, M., Yazid, S., Mohamadisa, H., & Nasir, N. (2016). Model development on awareness of education for sustainable schools development in Malaysia. *Indonesian Journal of Geography*, 48(1), 39–48.
- [20] Hines, J., Hungerford, H., & Tomera, A. (1986). Analysis and Synthesis of Research on Responsible Environmental Behaviour: A Meta-analysis. *Journal of Environmental Education*, 18(2), 1–8.
- [21] Jamilah, A., Shuhaida, M. N., & Nurzali, I. (2015). Investigating Students' Environmental Knowledge, Attitude, Practice and Communication. *Asian Social Science*, 11(16), 284–293.
- [22] Jennifer, C. B., Waliczek, T. M., & Zajicek, J. M. (1999). Relationship between environmental knowledge and environmental attitude of high school students. *The Journal of Environmental Education*, 30(3), 17–21.
- [23] John, A. (1995). Motor Imagery: Perception or Action. *Neuropsychologia*, 33(11), 1395–1417.
- [24] Julie, E., Nathaniel, B., & Thomas, B. (2015). Environmental action and student environmental leaders: exploring the influence of environmental attitudes, locus of control, and sense of personal responsibility. *Environmental Education Research*, 23(2), 149–175.

- [25] Kalaitzidis, D. (2012). Sustainable School Indicators: Approaching the vision through the sustainable School Award. Retrieved May 12, 2017, from [www.aeiforosxoleio.gr / content / ... /SusSchsAwardDimKalaitzid.d](http://www.aeiforosxoleio.gr / content / ... /SusSchsAwardDimKalaitzid.d).
- [26] Kimani, N. G. (2007). Environmental pollution and impacts on public health: Implications of the Dandora dumping site municipal in Nairobi, Kenya. Retrieved from [http://architectafrica.com/sites/default/files/UNEP\\_Dandora\\_2007.pdf](http://architectafrica.com/sites/default/files/UNEP_Dandora_2007.pdf)
- [27] Kollmuss, A., & Agyeman, J. (2002). Mind the Gap : why do people act environmentally and what are the barriers to, 8(3), 239–260. <http://doi.org/10.1080/1350462022014540>
- [28] Mehmet, E. (2009). Fifth grade students' environmental literacy and the factors affecting students' environmentally responsible behaviors. Retrieved from <https://etd.lib.metu.edu.tr>
- [29] Milutin, M., Stanko, C., & Sonja, I. (2014). Level of environmental awareness of students in republic of Serbia. World Journal of Education, 4(3), 13–18.
- [30] Mohammad Ohid, U., Md Abu, H., & Taj, U. (2013). Environmental awareness and disaster factors in Bangladesh. Journal of Applied Quantitative Method, 8(4), 34–42.
- [31] Neil, T., Tamar, D., Kathy, J., & Julie, K. (2007). Environmental knowledge and attitudes among a cohort of pre-service primary school teachers in Fiji. International Research in Geographical and Environmental Education, 16(4), 367–379.
- [32] Norazah, M. S. (2013). Structural relationships on consumer ecological behaviour. Journal of Sustainability Science and Management, 8(2), 236–243.
- [33] Norfadillah, D., Halimaton Saadiah, H., Noraziah, A., & Sarah, A. (2012). UKM sebagai kampus lestari: Tinjauan awal pengetahuan, kesedaran dan penglibatan pelajar dan kakitangan di Kampus UKM Bangi. Journal of Society and Space, 8(8), 76–90.
- [34] Norizan, E. (2010). Environmental knowledge, attitude and practices of student teachers. International Research in Geographical and Environmental Education, 19(1), 39–50.
- [35] Nurul Hidayah Liew, A., Haryati, S., & Seow, T. W. (2013). Pengetahuan dan tingkah laku murid terhadap alam sekitar: Satu kajian awal. In Persidangan Kebangsaan Geografi dan Alam Sekitar (pp. 343–347).
- [36] Pavlova. (2012). Generic Green Skills: Can They Be Addressed Through Technology Education? In Proceeding of the 7th Biennial International Conference on Technology Education (pp. 49–57). The Crowne Plaza Surfers Paradise, Australia.
- [37] Pedro, V.-M., Mercedes, V.-L., & Alvarez-Suarez, P. (2015). Evaluation of an educational model based on the development of sustainable competencies in basic teacher training in Spain. Journal Sustainability, 7(1), 2603–2622.
- [38] Stephen, J. K. (1995). Attitudes and the prediction of behaviour: A meta-analysis of the empirical literature. Society for Personality and Social Psychology, 21(1), 58–75.
- [39] Stern, P. C., & Thomas, D. (1994). The value basis of environmental concern. Journal of Social Issues, 50(3), 65–84.
- [40] Strietska-Illina, O., Hofmann, C., Haro, M. D., & Jeon, S. (2011). Skills for green jobs: A global view. International Labour Office, Geneva, ILO., 103–106.
- [41] Thompson, S., & Barton, M. (1994). Ecosentrist and anthroposentrist attitudes towards environment. Journal of Environmental Psy, 14(1), 149–157.
- [42] Tomporowski, P. (2003). Cognitive and behavioral responses to acute exercise in youth: A review. Pediatric Exercise Science, 15(1), 348–359.
- [43] UNESCO. (1977). Tbilisi declaration. Retrieved from <http://unesdoc.unesco.org/images/0003/000327/032763eo.pdf>
- [44] Yeung, S. P. (1998). Environmental Consciousness among Students in Senior Secondary Schools: the case of Hong Kong. Environmental Education Research, 4(3), 251–268.
- [45] Zurina, M., & Hukil, S. (2006). Hubungan alam sekitar dan nilai peribadi. Journal Pengajian Umum, 7(1), 1–12..