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Sustainability consciousness among pre-service teachers at the Institute of Teacher Education Malaysia: Expert review and exploratory factor analysis

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Abstract

Sustainability consciousness (SC) is an approach to assessing all elements of sustainable development from a holistic perspective. Global studies within teacher education settings began to pay attention to research on SC. The aim of this study was to adapt and examine an instrument for measuring SC among pre-service teachers at the Institute of Teacher Education Malaysia. The researchers adapted 27 items from the previous study for the SC construct. Expert panels verified the instrument's content, face, and criterion validity. Accordingly, the item statements were modified based on the feedback of experts. 111 pre-service teachers from six Institutes of Teacher Education in the Central Zone, South Zone, Sarawak Zone, and Sabah Zone were selected at random for the pilot test. The data were analyzed and verified using exploratory factor analysis (EFA). The outcome of the EFA procedure indicated that the 27 items may be categorized into three components. The items under these three components explained 65.1% of the total variance. The SC scale has an internal reliability of 0.96. In regard to contributing to the existing body of knowledge, the results provide a credible source of information for future studies on the SC of pre-service teachers to researchers and professionals.

Keywords: Exploratory factor analysis, Institute of Teacher Education, pilot test, pre-service teachers, sustainability consciousness

Introduction

Teacher education is crucial in educating students and developing sustainability awareness, knowledge, and skills (Gavinolla et al., 2022; Raman et al., 2022). Education for Sustainable Development (ESD) capacity development should be incorporated into the pre-service and in-service training and assessment of teachers in preschool, primary, secondary, and tertiary education, as well as adult education, by the leaders of teachers training institutions (UNESCO, 2020). This will contain educational material relevant to each Sustainable Development Goal (SDG) and transformational pedagogies that facilitate action for future sustainability.

Nonetheless, limited sustainability (Ellappan et al., 2018; Karim et al., 2021; Ratamun, 2019) and ESD research were conducted at the Institute of Teacher Education Malaysia (ITE) despite the institutions' support for ESD through the Sustainable ITE initiative (Karim et al., 2021). Sustainable ITE strives to inculcate a culture of sustainability in decision-making and action among aspiring teachers and local communities through suitable education, promoting awareness,

and adopting sustainable lifestyles. This effort alone needs further support and ongoing research to improve the integration of sustainability initiatives and ESD at all Malaysian ITEs.

According to national research, educators in Malaysia have clearly demonstrated that the concept of sustainability is not understood, and educators' knowledge is very limited because the scope of their knowledge of sustainability is extremely minimal and not intertwined with social and economic aspects (Mahat et al., 2016). According to UNESCO (2021), "Teachers can support students in acquiring the knowledge, competencies, attitudes, and behaviours essential to address global issues and facilitate the implementation of a more fair, harmonious, and sustainable society". Therefore, pre-service teachers must develop the required competencies prior to beginning their professional careers to be effective change agents (Adams & Muthiah, 2020). However, according to teachers who participated in the present survey, teacher education does not adequately address ESD themes; hence, many teachers inevitably feel unprepared to impart knowledge, value, and involvement in ESD topics (UNESCO, 2021).

Within the context of teacher education, SC among pre-service teachers is investigated either as a measurement of pre-service teachers' knowledge, awareness, and behaviours regarding sustainability or as an ESD outcome (Kalsoom et al., 2017; Sen et al., 2018). attempts to integrate the sustainable development aspects that encompass the UNESCO subthemes (Gericke et al., 2019). Generally, Gericke et al. (2019) defined SC as "an individual's experience and consciousness of sustainable development,". In future, teachers' SC must be extended to their pupils, and their future jobs must qualify them to make moral judgments in an uncertain future (Marcos-Merino et al., 2020). Consequently, teacher education must be enhanced to integrate ESD regarding the international SDGs.

It is strongly encouraged to evaluate the adapted instrument's reliability and validity. Numerous factors, such as culture, population, sample size, etc., may have an impact on the validity and reliability of the chosen questionnaire (Hajjar, 2018). Generally, assessing the reliability and validity of an adapted instrument is crucial for assuring accuracy, credibility, quality, and fairness (Chen et al., 2023; Oh et al., 2018; Wu et al., 2022). In this situation, a factor analysis test with reliability and validity is required. Therefore, it is desirable that when researchers adapt a previously reliable and valid scale, they make the proper modifications to its constructions to accommodate their topic and then assess the reliability and validity of this newly adapted scale. The focus of this study is to evaluate the validity and reliability of the Sustainability Consciousness Questionnaire (SCQ) by Gericke et al. (2019) in the context of Malaysian teacher education.

Literature review

Sustainability consciousness in global research

Research on SC has been done in many countries throughout the world. Berglund et al. (2014) carried out one of the early research studies on SC in Sweden. Their study's objective was to examine the effects of implementing ESD in Sweden with respect to promoting students' SC. Students from schools having a profile of ESD and comparable schools without a profile of ESD were included.

Sweden's research on SC continues to expand. Most of the research involves the SC of pupils (Boeve-de-Pauw et al., 2015; Olsson et al., 2016; Olsson & Gericke, 2016; Olsson & Gericke, 2017; Olsson, 2018). Numerous schools in Sweden have embraced ESD as an explicit

guiding approach to teaching throughout the past decade. Thus, the Swedish researchers compared the effect of this approach to that of students educated in conventional institutions. Correspondingly, the researchers developed the notion of SC to express a comprehensive understanding of sustainability. Within the framework of SC, the researchers explored the environmental, economic, and social aspects of sustainable development in terms of knowingness, attitudes, and behaviour.

Then, teacher education settings began to pay attention to research on SC. Global studies on the SC of pre-service teachers and teachers have been conducted (Kalsoom & Khanam, 2017; Kalsoom, 2017; Colas-Bravo et al., 2018; Sen et al., 2018; Guler et al., 2018; Marcos-Merino et al., 2020; Baena-Morales et al., 2021; Malandrakis, 2021; Nousheen & Kalsoom, 2022). Some of the studies mentioned were done in Pakistan, Spain, Turkey, and Greece.

In 2017, Kalsoom and Khanam from Pakistan utilised action research to improve the pre-service teachers' SC through inquiry-based learning. The research was expanded by Kalsoom et al. (2017), who examined the SC of pre-service teachers in Pakistan and compared it to that of other undergraduate students in Pakistan and Swedish high school students. The research on the SC of pre-service teachers expanded to Spain. Using the e-portfolio, Colas-Bravo et al. (2018) analysed the level of SC among Spanish pre-service teachers.

Additionally, research on SC within teacher education was conducted in Turkey in 2018 as well. Sen et al. (2018) were also interested in determining the level of SC among prospective Turkish teachers. To fulfil the objective, their research team (Guler et al., 2018) adapted Michalos et al. (2012) sustainability questionnaire into Turkish. Moreover, the number of scholars interested in the notion and theory of SC increased. Using the SCQ, Marcos-Merino et al. (2020) investigated the SC of Spanish pre-service primary teachers. Their findings demonstrate the need of teaching sustainability by seeking behavioural changes in the Primary Education Degree. Then, Baena-Morales et al. (2021) analyzed the SC of Physical Education teachers in Spain, and the results indicated that Physical Education teachers have a high consciousness of sustainable development (SD), apart from attitudes towards the economic dimension.

Malandrakis (2021) examined the influence of specific sustainability education pedagogies in raising the SC of Greek pre-service teachers. The investigation discovered a significant rise in scores for SC. Recently, in 2022, there have been more studies on SC conducted. Quantitative and qualitative evidence suggests that sustainability pedagogies improved the SC of pre-service teachers in online educational contexts during the COVID-19 pandemic (Nousheen & Kalsoom, 2022).

Sustainability consciousness research in Malaysia

There are very few studies on SC, particularly in Malaysia. One latest research has been conducted on SC from Malaysian universities (Saleem, 2022). Yet, Malaysian past research emphasises sustainability awareness or environmental awareness. Some of the studies are on sustainability awareness among university students (Wee et al., 2017; Jusoh et al., 2018; Mojilis, 2019). Lateh and Muniandy (2010) and Mahat and Idrus (2017) performed research on the environmental awareness of teachers. To fill the gap in Malaysian research, this study attempts to assess the SC among pre-service teachers at ITEs Malaysia. In addition, Malaysian teachers lack the resources necessary to convert into agents of sustainability transformation (Balakrishnan, 2021). According to Mokshein's (2019) research, while Malaysia has several policies promoting sustainability, their

implementation continues to have serious faults. As a result, the next challenge is to enhance and optimize the implementation of these policies and agendas, including teacher education.

Sustainability consciousness theory

The notion of sustainability consciousness discussed three constructs: knowingness, attitudes, and behaviour (Gericke et al. 2019). Each construct consists of environmental, social and economic aspects. Sustainability consciousness may also be considered as a comprehensive understanding of the environment, economy, and society, as well as the values, attitudes, and emotions that motivate pro-sustainability behaviour (Kalsoom et al., 2017). As previously said, individuals must acquire a wide sustainability consciousness, incorporating societal and economic perspectives, in addition to an environmental consciousness (Gericke et al., 2019). Furthermore, this theory is an extension of the Michalos et al. (2012) scale for evaluating knowledge, attitudes, and behaviour related to sustainable development, and in their study, they used the UNESCO framework as a theoretical foundation for developing the items.

Gericke et al. (2019) emphasised that by including the three psychological constructs of knowingness, attitudes, and behaviour in the Sustainability Consciousness Theory, a comprehensive approach to the research of people's cognitive and emotional views of Sustainable Development is adopted. The part on knowingness encompasses what individuals see as necessary characteristics of Sustainable Development. The attitude part represents people's views regarding Sustainable Development issues, while the behaviour part reflects what individuals do in response to the Sustainable Development topics under review. These three psychological categories (knowingness, attitude, behaviour) are then tied to the three Sustainable Development aspects: environment, society, and economy, according to the Sustainability Consciousness Theory. Therefore, the theory has nine subfactors, Environmental Knowingness, Environmental Attitude, Environmental Behaviour, Social Knowingness, Social Attitude, Social Behaviour, Economic Knowingness, Economic Attitude and Economic Behaviour.

Methodology

Adapted from Gericke et al. (2019), the SCQ is utilised to measure the SC construct and is intended for defining pre-service teachers' SC in the Malaysian context. The questionnaire was derived from three aspects of SC: knowingness, attitude, and behaviour. The categorical scale of this measurement is a five-point numerical scale. The score range of these existing measurements is from 1 means strongly disagreeing, to 5 means strongly agreeing with the statement.

Content validity

In this stage, the researchers selected the expert panel members based on their knowledge of the topic within the study which are sustainability and pre-service teacher training. Researchers selected six experts based on the recommendation by Yusoff (2019) that the minimum number of experts for content validation is six and the maximum is ten. To improve the credibility of the content validation procedure, the current study incorporated a sampling of six lecturers from teacher education institutions and public universities.

According to Yusoff (2019), developing a content validation form ensures the expert review panel has a clear knowledge of the assignment and its expectations. The instruments, definitions of terminology and relevance evaluation forms are provided to the experts. The researchers judged the individual items using a scale of relevance. There are four levels of relevance to the measured domain: not relevant, somewhat relevant, quite relevant, and highly relevant. The background of the panels is described in Table 1 below.

Table 1. The list of the panel for content validity

No	Educational background	Discipline	Position	Workplace	Years of experience
1	PhD	Human Geography, Sustainable Development Education	Lecturer	Public University	9
2	PhD	Islamic Law, Environmental Law	Lecturer	Public University	7
3	PhD	Environmental Management	Lecturer	Public University	15
4	PhD	Geography and Environment	Lecturer	Public University	9
5	PhD	Psychology of Child Development	Lecturer	Public University	4
6	PhD	Early Childhood Education	Lecturer	Institute of Teacher Education	15

Pre-testing and pilot test

Pre-testing the questionnaire is an essential aspect of the survey questionnaire development procedure (Ikart, 2019) to determine whether: respondents comprehend all terminology and concepts in the questionnaire, whether closed questions offer at least one answer option applicable to each respondent, and whether all responders interpreted the questions in the same manner, each survey question measures precisely what it should, and finally, whether any component of the questionnaire indicates researchers bias. Thus, the researchers conducted the pre-test with randomly chosen 21 pre-service teachers from one of the Institutes of Teacher Education in the Central Zone before conducting the pilot study.

The purpose of a pilot test is to determine whether something is feasible, whether the researchers should continue with the study, and if so, how (In, 2017). The pilot study for this research was conducted by distributing an online survey to 120 randomly chosen preservice teachers from six Institutes of Teacher Education located in the Central Zone, South Zone, Sarawak Zone and Sabah Zone as the pilot study subjects. Only 111 preservice teachers participated in the pilot study. Pre-service teachers from other teacher training institutions such as public universities were excluded from this current research. The ideal sample size for factor analysis is at least 100 (Hair et al., 2019; Kyriazos, 2018), which is adequate for this pilot test.

Exploratory Factor Analysis (EFA)

In the factor analysis technique, items with comparable characteristics are put together under a single component. Thus, instead of having to deal with many items, the researchers just must deal with a small number of components resulting from the procedure (Awang, 2012). For data reduction, EFA is employed in this study using cross-section data.

Five conditions must be fulfilled during EFA. First, the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy should surpass 0.50 (Hair et al., 2014). Second, Bartlett's sphericity test must be significant at $p < 0.001$ (Hair et al., 2014). Then, the EFA is achieved using the

principal component analysis (PCA) to extract factors and classify the number of factors retained. Variation is the most well-known and efficient orthogonal factor rotation method to explain the factor analysis (Hair et al., 2014, 2019). Third, the items that load higher than 0.55 are retained, while low-loading items than 0.55 are eliminated because 0.55 values and higher are significant in a sample of 100 respondents (Hair et al., 2019). Fourth, the measuring items are grouped into one dimension when the scale loading has eigenvalues of 1 and above (Tabachnick & Fidell, 2013). Next, the variance has to be higher than the recommended value of 60%, suggesting that the items correctly measure the constructs (Hair et al., 2014). Table 2 provides a summary of the EFA requirements for this study.

Table 2. Requirement for EFA

No	Indicator	Recommended value	Reference
1	Kaiser–Meyer–Olkin (KMO)	KMO> 0.50	Hair et al., 2014
2	Bartlett's test of Sphericity	Significant at $p < 0.001$	Hair et al., 2014
3	Factor loadings	Factor loading > 0.55	Hair et al., 2019
4	Eigenvalue	This study applied the scale loading with eigenvalues 1 and above	Tabachnick and Fidell 2013
5	Total variance explained	Total Variance explained > 0.60	Hair et al., 2014

Findings

Content validity result

The CVI was computed via the content validity procedure (I-CVI and S-CVI). Prior to computing CVI, the relevance rating was recorded as a score of 1 for a relevance scale of 3 or 4 or 0 for a relevance scale of 1 or 2. Table 3 contains the results.

Table 3. The relevance ratings on the item scale of the SCQ Construct by six experts

	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert in Agreement	I-CVI	UA
Item									
C1	1	1	1	1	1	1	6	1	1
C2	1	1	1	1	1	1	6	1	1
C3	1	1	1	1	1	1	6	1	1
C4	1	1	1	1	1	1	6	1	1
C5	1	1	1	1	1	1	6	1	1
C6	1	1	1	1	1	1	6	1	1
C7	1	1	1	1	1	1	6	1	1
C8	1	1	1	1	1	1	6	1	1
C9	1	1	1	1	1	1	6	1	1
C10	1	1	1	1	1	1	6	1	1
C11	1	1	1	1	1	1	6	1	1
C12	1	1	1	1	1	1	6	1	1
C13	1	1	1	1	1	1	6	1	1
C14	1	1	1	1	1	1	6	1	1
C15	1	1	1	1	1	1	6	1	1
C16	1	1	1	1	1	1	6	1	1

C17	0	1	1	1	1	1	5	0.83	0
C18	1	1	1	1	1	1	6	1	1
C19	1	1	1	1	1	1	6	1	1
C20	1	1	1	1	1	1	6	1	1
C21	1	1	1	1	1	1	6	1	1
C22	1	1	1	0	1	1	6	1	1
C23	1	1	1	1	1	1	6	1	1
C24	1	0	1	1	1	1	5	0.83	0
C25	1	1	1	1	1	1	6	1	1
C26	1	1	1	1	1	1	6	1	1
C27	1	1	1	1	1	1	6	1	1
							S-CVI/Ave	0.99	
Proportion relevance	0.96	0.96	1.0	0.96	1.0	1.0	S-CVI/UA		0.93
Average proportion of items judged as relevance across the six experts						0.98			

Referring to Table 2 above, it can be concluded that all the items have an I-CVI of at least 0.80, as proposed by Polit and Beck (2006) when there are at least six experts. According to the following data, all the items fulfil the minimal I-CVI level of 0.80. Likewise, the S-CVI score is 0.99. It indicates that the scale meets the S-CVI minimum requirement of 0.80. The six experts confirmed that this questionnaire is valid based on the conclusion of the content validation.

Moreover, some of the experts also gave their feedback to improve the items. Table 4 shows the summary of the feedback and revision done. Following the adjustment, the instrument is improved to better fit the respondent in the Malaysian setting.

Table 4. Summary of items feedback and revision.

Items number	Previous statements	Comments	Revision
C16	"I think that companies have a responsibility to reduce the use of packaging and disposable articles."	Expert 1: What kind of companies?	"I think that companies have a responsibility to reduce the use of packaging and disposable articles (e.g., Apple, Microsoft, Nestle, etc.)."
C19	"I recycle as much as I can."	Expert 1: What item you recycle?	"I recycle as much as I can (e.g., paper, plastic bottles, cans, etc.)."
C22	"When I use a computer or mobile to chat, to text, to play games and so on, I always treat others respectfully as I would in real life."	Expert 4: This sentence is quite long and carries a lot here.	"When I use a computer or mobile, I always treat others respectfully as I would in real life."

During the pre-test stage, after the pre-service teachers respond to the survey, they are asked several questions to obtain their feedback. Some of the main questions are;

1. "How long does the survey take to complete?"
2. "Are the instructions for each section clear?"
3. "Are the questions direct and concise?"
4. "Are the questions free of unnecessary technical language and jargon?"

5. "Are there questions that make respondents feel uncomfortable, embarrassed, annoyed or confused?"

The researchers received positive feedback from the pre-test session. The survey may be completed in five to ten minutes, according to most pre-service teachers. More than 90% of respondents said the instructions are easy, the survey questions are short and to the point, and there was no emotional disturbance. Following positive feedback, the researchers moves on to the pilot test.

EFA for SC

The survey contains 27 items for the SC construct during the pilot test. This construct was tested with an interval scale ranging from 1 (strongly disagree) to 5 (strongly agree) for each item statement. The Principal Component Factor Analysis (PCA) with Varimax Rotation was conducted on the 27 SC items. According to Table 5, Bartlett's Test of Sphericity was statistically significant (Chi-square = 2495.267, p-value 0.000). The Kaiser-Meyer-Olkin (KMO) sampling adequacy measure is 0.936. The KMO value of 0.936 in Table 3.29 is preferable because it is excellent and surpasses the required threshold of 0.6 (Awang, 2012). Two measurements (a KMO value close to 1.0 and Bartlett's test significance value close to 0.0) indicate that it is acceptable to proceed with the data reduction procedure.

Table 5. The KMO and Bartlett's test score

KMO and Bartlett's test		
Kaiser-Meyer-Olkin measure of sampling adequacy		0.936
Bartlett's Test of Sphericity	Approx. Chi-Square	2495.267
	df	351
	Sig.	.000

As illustrated in Figure 1, the scree plot for all items measuring this construct produced three components. It is obvious that there are three distinct components to this construct.

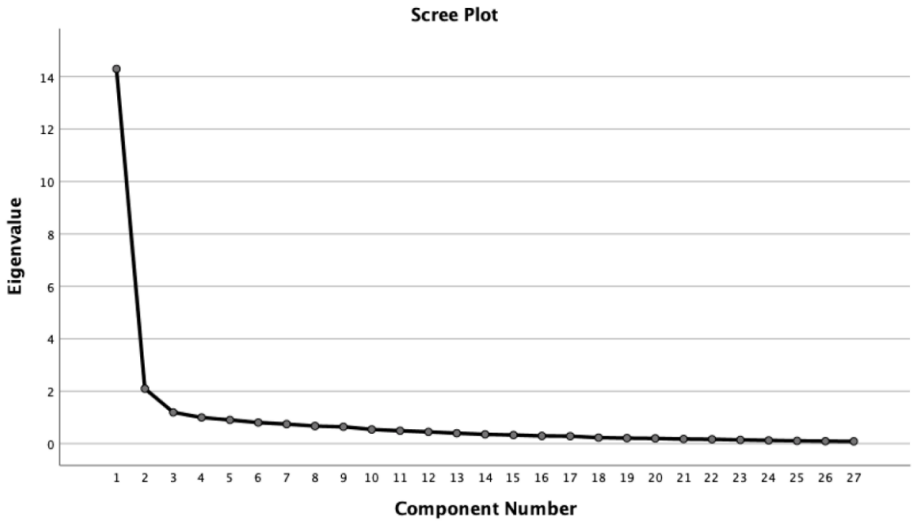

Figure 1. Scree Plot indicates extracted components for SC

The Total Variance Explained is an additional metric generated by EFA. This statistic, Total Variance Explained, represents the extent to which the measuring items employed to measure the constructs in the study successfully measure the relevant latent construct. Table 6 indicates that the measuring items for this construct may be categorised into three components, with the Total Variance Explained from these three components amounting to 65.131%. The component-by-component score in Table 3.30 explains the measurement contribution of each component. Component 1 contributes 40.149% of the output, component 2 contributes 17.209%, and component 3 contributes 7.773%. 65.131% of the Total Variance Explained for the construct is appropriate since it exceeds the minimum requirement of 60% (Awang, 2012; Shkeer & Awang, 2019).

Table 6. The total variance explained for SC items

Total variance explained						
Component	**Initial eigenvalues**			**Rotation sums of squared loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	14.295	52.946	52.946	10.840	40.149	40.149
2	2.098	7.770	60.715	4.647	17.209	57.358
3	1.192	4.416	65.131	2.099	7.773	65.131

Extraction method: Principal component analysis

Table 7 displays the factor loadings for each of the three components for each of the 27 items. The next step is to determine the items for each component. The following table demonstrates that the SC construct is comprised of three components. C10 is the only item with a low loading factor. Since the factor loading is less than 0.55, item C10 are being eliminated.

Table 7. The rotated component matrix for SC

Rotated component matrix			
	Component		
	1	2	3
C3	0.784		
C4	0.664		
C5	0.655		
C6	0.725		
C7	0.860		
C8	0.820		
C9	0.695		
C11	0.749		
C12	0.766		
C13	0.817		
C14	0.777		
C15	0.866		
C16	0.788		
C17	0.769		
C18	0.637		
C22	0.655		
C24	0.740		
C27	0.574		
C19		0.742	
C20		0.657	
C21		0.620	

C23	0.668	
C25	0.753	
C26	0.684	
C1		0.604
C2		0.688

Thus, the total number of items constituting the construct of SC is 26, with the three components listed in Table 8.

Table 8. The total items and three components of SC

Component	N of items	Items
1	18	C3, C4, C5, C6, C7, C8, C9, C11, C12, C13, C14, C15, C16, C17, C18, C22, C24, C27
2	6	C19, C20, C21, C23, C25, C26
3	2	C1, C2
All items	**26**	

The number of items and components in the Malaysian setting may differ from the prior study. According to the findings of this study, the dimensionality of a single construct may change between situations. It happens in the Malaysian context, which has varying aspects for assessing SC, which might be tied to culturally different beliefs on sustainability.

The instrument's internal reliability

The purpose of the reliability measurement is to assess the measuring items for each component. The internal reliability of the items was determined using Cronbach's alpha value. Internal reliability examines the efficiency of a group of items in assessing a construct. Since this construct is measured by three components, the researchers must evaluate the internal consistency of all three. Each component's Cronbach Alpha value is displayed in Table 9. The Cronbach's alpha must be greater than 0.7 for the items to be considered internally reliable (Shkeer & Awang, 2019; Fitriana et al., 2022) and all three components have Cronbach Alpha values higher than 0.70. Results suggest the measurement items for this SC construct are reliable enough for use.

Table 9. The reliability of SC construct

Component	N of items	Cronbach's Alpha
1	18	0.967
2	6	0.840
3	2	0.736
All items	**26**	**0.960**

Evaluating the reliability and validity of an adapted SC instrument is strongly encouraged for several reasons. Firstly, the researchers need to ensure the accuracy of the instrument. Evaluating the reliability and validity of an instrument helps to ensure that it accurately measures what it is intended to measure (Wu et al., 2022). This is important because inaccurate measurements can lead to incorrect conclusions and decisions. Secondly, establishing the reliability and validity of an instrument can increase its credibility and acceptance in the scientific

community (Oh et al., 2018). This is important because researchers need to be able to trust the instrument, they use to collect data.

Moreover, this process will aid in improving the instrument quality (Chen et al., 2023). The process of evaluating the reliability and validity of an instrument can help identify areas for improvement and refinement. This can lead to the development of better instruments that are more accurate and reliable. Other than that, evaluating the reliability and validity of an instrument can help ensure that it is fair and unbiased (Wu et al., 2022). This is important because unfair or biased instruments can lead to inaccurate conclusions and decisions and can also have negative consequences for individuals or groups that are unfairly impacted. Overall, evaluating the reliability and validity of an adapted instrument is essential for ensuring accuracy, establishing credibility, improving instrument quality, and ensuring fairness (Chen et al., 2023; Oh et al., 2018; Wu et al., 2022).

Conclusion

The current study adapts the instrument for measuring SC among pre-service teachers at the Institute of Teacher Education Malaysia. According to this study's findings, a specific construct's dimensionality may vary across contexts. It occurs in the Malaysian setting, which has varied dimensions for measuring SC, which can be related to the diverse ideas on sustainability among cultures. This study's findings indicate that the SC scale has great psychometric properties and is highly valid and reliable. It may be determined that SC consists of 26 items and three different components that exhibited enough differences to warrant consideration as a distinct construct. This study can assist other researchers interested in studying SC in Malaysia, particularly among pre-service teachers.

One of the study's limitations is that it only included pre-service teachers from Malaysian teacher education institutes. In order to obtain more definitive results, it would be promising to increase the sample size to include more pre-service teachers from various Malaysian institutions such as public and private higher education institutes for future studies. Furthermore, the sample may include a variety of selections from science, art, and sports education for comparison. Because of the different educational backgrounds involved, this type of research is particularly intriguing. Furthermore, the study's population primarily reflects the situation in Malaysia. Thus, future studies may gather more samples from different nations in order to provide a more broad view. Finally, this study is only applicable to higher education levels. Nonetheless, a comparable future study might be conducted at all academic levels.

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References

Adams, D., & Muthiah, V. (2020). Teacher education in Malaysia: Practices, challenges and future

trends for the twenty-first century. In K Pushpanadham (Ed.), *Teacher education in the global era: Perspectives and practices*, (pp. 133-144). Springer.

Awang, Z. (2012). *Research methodology and data analysis*. (2nd ed). Universiti Sultan Zainal Abidin.

Baena-Morales, S., Ferriz-Valero, A., Campillo-Sánchez, J., & González-Víllora, S. (2021). Sustainability awareness of in-service physical education teachers. *Education Sciences, 11*(12), 798.

Balakrishnan, P. (2021). ESD in Malaysia: Challenges and Strategies. In Iyengar R. & Kwauk C.T (Eds.), *Curriculum and Learning for Climate Action* (pp. 261-275). Brill.

Berglund, T., Gericke, N., & Chang Rundgren, S. N. (2014). The implementation of ESD in Sweden: Investigating the sustainability consciousness among upper secondary students. *Research in Science & Technological Education*, *32*(3), 318-339.

Boeve-de Pauw, J., Gericke, N., Olsson, D., & Berglund, T. (2015). The effectiveness of ESD. *Sustainability, 7*(11), 15693-15717.

Chen, I. C., Li, C. Y., Lu, C. Y., Huang, Y. C., Lee, P. C., Lin, M. Y., Wang, Y. C., Chen, L. S., Kuo, C. L., & Hou, W. H. (2023). Psychometric properties of novel instrument for evaluating ambient air pollution health literacy in adults. *Plos one*, *18*(6), e0285001. Retrieved from https://doi.org/10.1371/journal.pone.0285001

Colas-Bravo, P., Magnoler, P., & Conde-Jiménez, J. (2018). Identification of levels of sustainable consciousness of teachers in training through an e-portfolio. *Sustainability, 10*(10), 3700.

Ellappan, M. R., Mahat, H., & Nayan, N. (2018). Pelaksanaan pendidikan pembangunan lestari dalam konteks sikap pentadbir di Institut Pendidikan Guru Malaysia. (Implementation of sustainable development education in attitude context among administrators of Malaysian Teacher Education Institute (IPGM)). *GEOGRAFI*, *6*(1), 50-60.

Fitriana, N., Hutagalung, F. D., Awang, Z., & Zaid, S. M. (2022). Happiness at work: A cross-cultural validation of happiness at work scale. *Plos one*, *17*(1), e0261617. Retrieved from https://doi.org/10.1371/journal.pone.0261617

Gavinolla, M. R., Livina, A., & Swain, S. K. (2022) State of the research on teacher education and sustainability: A bibliometrics analysis. *Journal of Teacher Education for Sustainability*, *24*(2), 147-165.

Gericke, N., Boeve-de Pauw, J., Berglund, T., & Olsson, D. (2019). The Sustainability Consciousness Questionnaire: The theoretical development and empirical validation of an evaluation instrument for stakeholders working with sustainable development. *Sustainable Development, 27*(1), 35-49.

Guler, F., Şen, M., Ozdemir, M., & Oztekin, C. (2018). *Adaptation and validation of the sustainability consciousness questionnaire for teacher candidates.* 1. https://eera-ecer.de/ecer-programmes/conference/23/contribution/43972/

Hair, J.F., Black, W.C., Rabin, B.J. & Anderson, R.E. (2019). *Multivariate Data Analysis* (8th Ed). Cencage Learning EMEA.

Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2014). *A primer on partial least squares structural equation modeling (PLS-SEM)*. Sage publications.

Hajjar, S. T. (2018). Statistical analysis: Internal-consistency reliability and construct validity. *International Journal of Quantitative and Qualitative Research Methods*, *6*(1), 27-38.

Ikart, E. M. (2019). Survey questionnaire survey pretesting method: An evaluation of survey questionnaire via expert reviews technique. *Asian Journal of Social Science Studies*, *4*(2), 1.

In, J. (2017). Introduction of a pilot study. *Korean Journal of Anesthesiology*, *70*(6), 601-605.

Jusoh, S., Kamarudin, M. K. A., Wahab, N. A., Saad, M. H., Rohizat, N. H., & Mat, N. H. N. (2018). Environmental awareness level among university students in Malaysia: A review. *International Journal of Engineering & Technology*, *7*(4.34), 28-32.

Kalsoom, Q. & Khanam, A. (2017). Inquiry into sustainability issues by pre-service teachers: A pedagogy to enhance sustainability consciousness. *Journal of cleaner production, 164*, 1301-1311.

Kalsoom, Q., Khanam, A., & Quraishi, U. (2017). Sustainability consciousness of pre-service teachers in Pakistan. *International Journal of Sustainability in Higher Education*, 18(7), 1090-1107.

Karim, A. A. A., Abdullah, S., Ayub, A. F. M., & Sharaai, A. H. (2021). Critical success factors of knowledge on sustainability in Malaysian Higher Education. *Turkish Journal of Computer and Mathematics Education*, *12*(5), 74-83.

Kyriazos, T. A. (2018). Applied psychometrics: Sample size and sample power considerations in factor analysis (EFA, CFA) and SEM in general. *Psychology*, *9*(8), 2207.

Lateh, H., & Muniandy, P. (2010). Environmental education (EE): current situational and the challenges among trainee teachers at teachers training institute in Malaysia. *Procedia-Social and Behavioral Sciences*, *2*(2), 1896-1900.

Mahat, H., & Idrus, S. (2017). Education for sustainable development in Malaysia: A study of teacher and student awareness. *Geografia-Malaysian Journal of Society and Space*, *12*(6), 77-88.

Mahat, H., Hashim, M., Saleh, Y., Che Ngah, M. S. Y., & Nayan, N. (2016). Aspek kritikal pendidikan pembangunan lestari berdasarkan data temu bual guru. *EDUCATUM–Journal of Social Science*, *2*(1), 52-66.

Malandrakis, G. (2021). The contribution of sustainability education pedagogies to the development of Greek pre-service teachers' sustainability consciousness about social issues in urban environments. *Environmental Education Research*, *28*(3), 382-404.

Marcos-Merino, J. M., Corbacho-Cuello, I., & Hernández-Barco, M. (2020). Analysis of sustainability knowingness, attitudes and behavior of a Spanish pre-service primary teachers sample. *Sustainability,12*(18), 7445.

Michalos, A. C., Creech, H., Swayze, N., Maurine Kahlke, P., Buckler, C., & Rempel, K. (2012). Measuring knowledge, attitudes and behaviours concerning sustainable development among tenth grade students in Manitoba. *Social indicators research*, *106*(2), 213-238.

Mojilis, F. (2019). Sustainability Awareness of students from a green university in Sabah, Malaysia. *Journal of Tourism, Hospitality and Environment Management*, *4*(13), 24-33.

Mokshein, S. E. (2019). Education for Sustainable Development (ESD) in Malaysia: Policy, program and evaluation. In *Proceedings of the 3rd International Conference on Current Issues in Education (ICCIE 2018).* Atlantis Press.

Nousheen, A., & Kalsoom, Q. (2022). Education for sustainable development amidst COVID-19 pandemic: Role of sustainability pedagogies in developing students' sustainability consciousness. *International Journal of Sustainability in Higher Education*, 23(6), 1386-1403.

Oh, J. A., Kim, Y. Y., Yoo, S. Y., & Cho, H. (2018). Validity and reliability of the Korean version of the families' importance in nursing care-pediatric nurses' attitudes instrument. *Child Health Nursing Research*, *24*(3), 274-286.

Olsson, D., Gericke, N., & Chang Rundgren, S. N. (2016). The effect of implementation of ESD in Swedish compulsory schools–assessing pupils' sustainability consciousness. *Environmental Education Research*, *22*(2), 176-202.

Olsson, D., & Gericke, N. (2017). The effect of gender on students' sustainability consciousness: A nationwide Swedish study. *The Journal of Environmental Education*, *48*(5), 357-370.

Olsson, D. (2018). *Student sustainability consciousness: Investigating effects of ESD in Sweden and beyond* [Doctoral Dissertation, Karlstads Universitet]. Faculty of Health, Science and Technology.

Polit, D. F., & Beck, C. T. (2006). The content validity index: are you sure you know what's being reported?. Critique and recommendations. *Research in nursing & health*, *29*(5), 489-497.

Raman, F. I., Hutagalung, F. D. & Abdul Rahman, M. N. (2022). Preparing pre-service teachers for integration of education for sustainable development in school: A systematic review (2013-2022). *Geografia-Malaysian Journal of Society and Space*, *18* (3), 153-169.

Ratamun, L. M. (2019). Pengetahuan dan amalan kitar semula oleh guru pelatih Institut Pendidikan Guru. *Jurnal penyelidikan IPGK*, *16*, 1-16.

Saleem, A., Aslam, S., Sang, G., Dare, P. S., & Zhang, T. (2023). Education for sustainable development and sustainability consciousness: Evidence from Malaysian universities. *International Journal of Sustainability in Higher Education*, *24*(1), 193-211.

Şen, M., Guler, F., Ozdemir, M., & Oztekin, C. (2018). *Uncovering teacher candidates' sustainability consciousness level.* European Educational Research Association. Retrieved from https://hdl.handle.net/11511/79135

Shkeer, A. S., & Awang, Z. (2019). Exploring the items for measuring the marketing information system construct: An exploratory factor analysis. *International Review of Management and Marketing*, *9*(6), 87-97.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Pearson.

UNESCO. (2020). Education for Sustainable Development: A Roadmap. UNESCO

UNESCO. (2021). Teachers have their say: Motivation, skills and opportunities to teach. ESD and global citizenship. Report of global teacher survey conducted by Education International and UNESCO. UNESCO. https://www.ei-ie.org/en/item/25552

Wee, M. I., Ariffin, F. N., Ng, T. F., & Shabudin, A. F. A. (2017). Awareness and attitudes towards sustainable development amongst higher education students in Penang, Malaysia. In Filho, W.L., Azeiteiro, U.M, Alves, F., & Molthan-Hill, P. (Eds.), *Handbook of theory and practice of sustainable development in higher education* (pp. 49-64). Springer.

Wu, J. L., Huang, Y. H., Huang, Y. C., Hou, W. H., Jung, C. C., Lee, P. C., Lin, M. Y., & Li, C. Y. (2022). Psychometric properties of a novel instrument for evaluating indoor air pollution health literacy in adults. *Indoor air*, *32*(11), e13155.

Yusoff, M. S. B. (2019). ABC of content validation and content validity index calculation. *Resource*, *11*(2), 49-54.