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Engagement and commitment in Eco-Campus activities of pre-service teachers: Confirmatory factor analysis

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ABSTRACT

This study was conducted to confirm the instrument of sustainability engagement and commitment in Eco-Campus activities of pre-service teacher. Respondents consisted of 500 pre-service teachers who were selected using stratified sampling techniques. The variables studied or the factors generated from exploratory factor analysis (EFA) of this study include knowledge, attitude, engagement, and commitment. Data were analyzed descriptively to obtain the reliability of the Cronbach's alpha value and confirmatory factor analysis (CFA) was used to obtain a four-factor solution using SPSS 22 and AMOS 20 software. The results of the analysis showed that the Cronbach's alpha value was in the high classification of more than 0.80. The results of the CFA analysis for the measurement model showed that the four-factor solution was compatible and acceptable based on the recommended fit indices (CMIN=214.073, DF=49, CMIN/DF=4.369, p=.000, GFI=.941, CFI=.971, TLI=.961, RMSEA=.082). As a result, the 36-item measuring model created was suitable for assessing sustainability participation and commitment in Eco-Campus activities, particularly among pre-service teachers in Malaysia.

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1. INTRODUCTION

Fast-growing modernization has brought many changes with both positive and negative implications for the country. The environmental, economic, social, and cultural imbalances of the local community are no exception in being deeply affected. However, there are some who think that this is a necessary evil that needs to happen in the name of development [1]. As a result, many have taken this for granted which has led to negative consequences, especially regarding the environment. Therefore, to address this problem so that it will not become worse, awareness through education should be instilled from an early age.

Community development towards equality and sustainability is highly dependent on education, acknowledging that in 2005, the United Nations launched the decade of education for sustainable development (DEfSD) to take charge of this role. DEfSD goal for the period 2005 to 2014 is to integrate the values, principles and practices of sustainable development into all aspects of education and learning. This concept was re-emphasized during the born declaration in 2009 with the statement that education for sustainable development (ESD) is a new way of learning and education for all [2]. The main purpose is to promote high quality education to all people based on the values, principles and practices needed to face the challenges of the future, especially in the era of the Industrial Revolution 4.0. Furthermore, at the Rio

Conference, the importance of education in promoting sustainable development has been explained through Local Agenda 21 (LA21) which states that education needs to be recognized as an individual and societal process go through to reach their full potential. The relationship between ESD and sustainable development aims to identify priorities to outline the three main elements, namely environmental, economic and social factors. The role must be play by educational institutions in disseminating knowledge, developing the culture of the nation, and honing the potential or talent of students [3]. Even though environmental education (EE) could take place anywhere, the principal locations for learning about it are schools and higher learning institutions. Furthermore, ESD is a process of creating the interaction between environmental, ecological, socioeconomic, and political qualities, not just an EE technique [4].

Therefore, awareness through sustainability practices is important to maintain environmental, economic, and social harmony. The involvement of community members especially the young is needed to improve this practice. In Malaysia, the government has implemented various policies and laws including regulations and programs to realize environmental sustainability is one of the goals of the *Rancangan Malaysia 11* (RMK11). This existing policy provides guidance to all parties including government agencies at the federal or state level and local authorities (PBT), the industrial sector and the community which aims to help minimize their environmental impact on future generations. In fact, various efforts have been made either from the 'top-down' or the 'bottom-up' levels to make community members aware of their responsibility towards the environment [5]. However, the environmental conservation effort is still vaguely successful, but it is not a reason to end the effort to protect the environment in a country. The more important thing that a country can do is to make improvements in every issue that arises and tries to deal with each one effectively.

Therefore, a deeper appreciation needs to be instilled among the younger generation at the university who are the main group that needs to be targeted when it comes to engagement in environmental sustainability efforts. Efforts need to be made to study students' engagement in environmental protection activities in order to form a more sustainable individual–environment and environmental transformation. Thus, a study on the engagement and commitment towards Eco-Campus activities among students was conducted through identification of items to determine and measure the level of sustainability, engagement, and commitment of the Eco-Campus activities of pre-service teacher in Malaysia.

The world hit by an environmental crisis that is a challenge today. Several agreements and declarations have been introduced globally such as the Stockholm Declaration (1972), the Langkawi Declaration (1989), and the Kyoto Protocol (2004) whose goals are dedicated to progressing environmental sustainability. One of them is to foster understanding and practice at the tertiary educational level. The Talloires Declaration introduced in 1990 has created awareness and responsibility for the management of higher education (universities and colleges) to preserve ecological, social, and economic sustainability, especially for residents living on campus [6]. The role of institutions to inculcate learning and understanding of fostering environmental sustainability is in line with the [7] program which has been recognized globally as the main leader for the ESD (2005–2014) program. This program emphasizes the overwhelming importance of awareness at both college and university education levels of environmental sustainability [8].

Most of the campus universities in Malaysia are found to have implemented sustainability awareness programs among university residents as universities are a center of knowledge and innovation: a suitable place to cultivate the development of ideas in the form of campus sustainability activities better known as Eco-Campus. The Eco-Campus idea is one of the concepts of sustainable development and is also one of the parts of the concept of sustainable higher education (SHE). The sustainable campus is one of the higher learning institutions that largely or entirely covers regional and global engagement and promotion [9]. In addition, this concept leads to minimizing an adverse effect on the environment, economy, social, and health generated in the use of resources to meet the teaching, research, and knowledge sharing functions in various ways to help society to live sustainably.

The concept of the sustainable campus or Eco-Campus is an act of taking responsibility for the protection and improvement of human health, wellbeing, and ecosystems. This process involves the understanding and knowledge of all campus residents with an aim to meet the needs of present and future generations [10]–[12] conclude that campus sustainability is a balance of activities involving economic, social, and environmental factors as seen through indicators such as the preservation of campus greenery, noise control, energy saving, and environmental conservation. In addition, Eco-Campus is also a strategy to improve sustainable practices on campus by raising awareness among students and staff about related issues on sustainability [13].

Various attempts have been done at the university level, particularly in Malaysia, to incorporate the concept of sustainability. The programs conducted start with students' engagement in Eco-Campus activities carried out by the university as well as their consideration of the university landscape. Managing landscape resources through landscape management, waste management; its functions and activities implemented by the university through continuous teaching, implementation research, operations, and coordination to reduce

the negative impact on the environment will form a sustainable campus environment. At the same time, this also leads to an emphasis on the health and wellbeing of the campus community [14].

Thus, Eco-Campus acts as a model in the efforts to achieve campus sustainability. It is known as the Environmental Management System at the higher learning institution and was launched by the Council of Higher Education in England in 2006 [8]. This system allows universities to get recognition for addressing key environmental sustainability issues including carbon reduction. [10] state that one of the factors that can generate environmental sustainability in the campus area is control of the process of carbon dioxide production. Gas emissions are a major producer of campus pollution generated both directly and indirectly through transportation systems [8]. The main values of Eco-Campus include five elements as shown in Figure 1 [15].

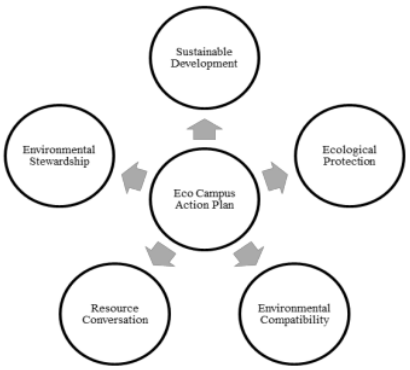

Figure 1. Eco-campus core values

These five values should be nurtured indirectly in every student who is a possible future leader of the country and the university is a suitable place to introduce the concept of sustainability practices through Eco-Campus activities. When the students apply these practices, it will help foster this concept in their community when they later enter the world of work [16]. However, the practices of environmental care are seen to be very low among students. This statement is in line with opinion [17] who stated that students were much less interested in getting to know about the environment because they did not exercise practices which lead to environmental sustainability. There are some practices known by students based on studies but the results of the studies found that the respondents had only practiced sustainability through respecting their local landscape by not destroying the plants, in addition to recycling which can aid environmental sustainability.

Therefore, the practice of environmental sustainability engagement needs to be promoted among young people, especially those who are still studying at higher learning institutions (HLI). Awareness related to the environment is one of the contributing factors that can create sustainable practices in society [18]. However, there are still a few models that study psychometric features in the implementation and commitment towards Eco-Campus activities. Therefore, this study aims to build and validate the Eco-Campus engagement commitment model among pre-service teacher at Universiti Pendidikan Sultan Idris (UPSI) using factor analysis.

The teacher commitment model for teaching EE was used as a basis for building and validating the Eco-Campus engagement commitment model among pre-service teacher of UPSI through factor analysis. Four main theories served as the basis in the formation of this model, namely field theory [19], theory of planned behavior (TPB) [20]; lifespan developmental theory [21], and the study of life experiences influencing environmentally responsible behavior [22]–[24]. This model involves a theoretical framework that looks at life experiences in shaping teachers' tendency to teach despite the obstacles as presented in Figure 2. The element of life experience is an addition to the organized behavior theory in predicting and explaining the antecedents that are related to teaching EE. The EE commitment model is largely influenced by TPB.

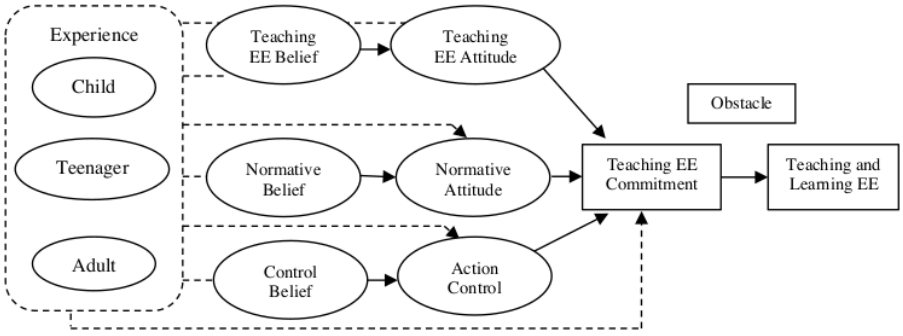

Figure 2. Environmental education commitment model [25]

This experience can be a standalone construct or a combination of life experience constructs. Teachers whose childhoods were exposed to outdoor activities, reading magazines and books about nature, and who spent a lot of time surrounded by nature were influenced by these experiences in their commitment towards the environment. Teachers who engaged in hands-on activities about EE during their college years and attended EE workshops have a stimulus to teach EE. Similarly, the experience of teachers during adulthood can also affect their commitment. In summary, experience and life stage can influence teachers' commitment to teaching EE [26].

The selection of this model as a guide was based on the use of the theory of organized behavior in explaining various types of behavior [20], [27] and proof that life experience does influence commitment towards environmental issues [22]. For example, the use of the theory of organized behavior has been demonstrated in predicting environmental behavior [28], [29] and in predicting teachers' intentions and commitment towards EE teaching [30]–[32]. Therefore, this model can be used as a guide in placing the position of commitment after the occurrence of action/behavior. Thus, the Teacher Commitment Model to teach EE is suitable to be used as a platform in building a model of Eco-Campus engagement commitment among pre-service teacher of UPSI through factor analysis.

2. RESEARCH METHOD

2.1. Study design

This research validated the construct of sustainability engagement and commitment in Eco-Campus activities of pre-service teacher using confirmatory factor analysis (CFA). This study using descriptive design and the location of the study involved pre-service teacher from UPSI, Malaysia. The university was chosen as the study location since it is a school that prepares future teachers for Malaysian schools.

2.2. Study population and sample

Respondents were chosen from final-year students who had already completed teacher training in school and might be considered pre-service teachers. The population was originally identified, with 17,893 bachelor's degree in education students. The percentage of the population was then calculated to get the sample size. Saturated data 367, according to Krejcie and Morgan, although in this case, 500 samples were chosen as long as the data more than the suggested sample data as described in Table 1.

Table 1. Respondents profile by faculty

Faculty	Number of Population	Percentage (%)	Number of Sample
Faculty of Language and Communication (FBK)	2756	15.40	77
Faculty of Music and Performing Arts (FMSP)	717	4.01	20
Faculty of Management and Economics (FPEK)	1939	10.84	54
Faculty of Education and Human Development (FPPM)	2067	11.55	58
Faculty of Human Sciences (FSK)	2703	15.11	76
Faculty of Art, Computing and Creative Industry (FSKIK)	2736	15.29	76
Faculty of Science and Mathematics (FSMT)	2433	13.60	68
Faculty of Sports and Coaching (FSSKJ)	1502	8.39	42
Faculty of Technical and Vocational Education (FTV)	1040	5.81	29
Total	17893	100	500

2.3. Study instrument

Instrument development was through a validity and reliability phase. There were five Malaysian environmental education experts examined the instrument's validity. Prior to the actual investigation, a pilot study comprising 100 sample with the same characteristics as the actual population was carried out. In this research, a questionnaire was used as an instrument; it contained five sections, namely Sections A, B, C, D, and E as shown in Table 2. Section A contains the demographic information of the respondents while Sections B to E cover the information of the study variables, namely Eco-Campus knowledge, attitude towards Eco-Campus activity engagement, Eco-Campus activity engagement, and Eco-Campus activity commitment. Table 3 shows the constructs, items, and statements.

Table 2. Respondent questionnaire information

Section	Variable	Sub variable	No. of item	Source of item
A	Background of respondents	Faculty	11	Developed as appropriate
		Gender	2	
		Race	7	
B	Knowledge of eco campus		10	Developed by [33]
C	Attitudes towards participation in Eco-Campus activities		10	Developed by [34]
D	Participation in Eco-Campus activities		10	Developed by [35]
E	Commitment in Eco-Campus activities		10	Developed by [34]

Table 3. Constructs, items, and statements

Construct	Item	Statement
Knowledge of Eco Campus	a1	Eco-campus is one of the efforts to sustain the environment.
	a2	Eco-campus can increase awareness to implement environmental protection activities.
	a3	Sustainable development is the main core value in Eco-Campus.
	a4	Ecological protection is the main core value in Eco-Campus.
	a5	Environmental stewardship is the main core value in Eco-Campus.
	a6	Resource conservation is the main core value in Eco-Campus.
	a7	Environmental compatibility is the main core value in Eco-Campus.
	a8	The implementation of Eco-Campus programs only involves university administrators.
	a9	Eco-campus programs can reduce maintenance costs within the campus.
	a10	Eco-campus programs can balance the ecosystem within the campus.
Attitudes towards participation in Eco-Campus activities	a11	I believe every member of the university should be supportive in sustaining the environment within the campus area.
	a12	I believe the university should always implement sustainability planning every day.
	a13	I believe the university should always implement sustainable development every day.
	a14	I believe the university should always implement sustainability operations every day.
	a15	I believe environmental education needs to be enacted into T&L curriculum at the university.
	a16	I believe that university students are role models to the outside community in carrying out environmental protection activities.
	a17	I will help create a sustainable campus, community, and world.
	a18	I will be angry if there are parties who damage the environment arbitrarily.
	a19	I will support the university's efforts for the environment to be preserved and conserved.
	a20	I will participate in university's initiatives for the environment to be preserved and conserved.
Participation in Eco-Campus activities	a21	I participate in environmental related programs organized by UPSI.
	a22	I am involved in sustainability programs with the community outside UPSI's campus.
	a23	I give out ideas to the UPSI administration about programs involving the environment.
	a24	I am involved as a committee member of Eco-Campus programs at UPSI.
	a25	I am involved in electricity-saving program on campus.
	a26	I am involved in water-saving program on campus.
	a27	I am involved in 3R program on campus.
	a28	I encourage my friends to get involved in environmental protection programs.
	a29	I use a more environmentally friendly travel mode.
	a30	I buy things that are environmentally friendly.
Commitment in Eco-Campus activities	a31	I want to participate in my university initiative to protect the environment.
	a32	I want to help create a sustainable campus, community, and world.
	a33	I am interested in participating as an environmental volunteer.
	a34	I am ready to participate in recycling programs conducted for Eco-Campus.
	a35	I must be an eco-icon for the UPSI Eco-Campus campaign.
	a36	I am eager to attend every UPSI's Eco-Campus program.
	a37	I want my friends to also participate in Eco-Campus activities.
	a38	I will continue carrying out eco-activities even after graduating.
	a39	I am ready to share information regarding environmental protection activities within the UPSI campus.
	a40	I am willing to spend my own money to carry out environmental activities within the UPSI campus.

Then, reliability test was carried out to determine the applicability of the instrument in the research. Table 4 shows the reliability of the element of students' Eco-Campus engagement with the Cronbach's alpha values that measure the internal consistency of the variables. According to previous research [36], reliability values are classified based on the classification of the reliability index where 0.00-0.30 is low, 0.30-0.69 is moderate, 0.70-0.89 is high and 0.90-1.00 is considered as very high. The results of the reliability analysis show that the Cronbach's alpha value exceeds 0.80 which is at high and very high classification. According to Babbie classification [37], this study instrument has high reliability.

Table 4. Study questionnaire reliability

Variable	No. of Item	Alpha Cronbach
Knowledge of eco campus	10	.775
Attitudes towards participation in Eco-Campus activities	10	.911
Participation in Eco-Campus activities	10	.939
Commitment in Eco-Campus activities	10	.895

2.4. Data analysis method

The items applied in this research were related to sustainability engagement and commitment towards Eco-Campus activities of pre-service teacher. Each variable was conducted a reliability analysis to determine their respective level of reliability. Then the profile or demographic information of the respondents who participated in this study was analyzed using descriptive methods to obtain the frequency and percentage values for each demographic factor. Next, EFA analysis was performed on the study items using the data. The purpose of this EFA analysis was to study how the item works are arranged according to a particular group of factors [36]. The next step is to validate the hypothesis model using the structural modelling equation method through CFA.

Factor analysis is intended to identify the correlation between variables. Variables that are highly correlated will generate new patterns. According to previous researchers [38], [39], factor analysis is a method for obtain a new group of variables with a smaller number than before. Factor analysis can be classified into two, namely EFA analysis and CFA.

Exploratory factor analysis can be described as a method aimed at summarizing connected variables. This is a technique used to reduce the number of variables by identifying the number of latent constructs and factors underlying a set complete variable. According to Child [40], EFA is used to explore the factor structure that may form the basis of the formation of a set of variables studied before performing further analysis. The number of constructs and structure factors that are the main pillars of the studied variables can be determined through the EFA analysis method. The factor structure constructed is guided by the feedback of the findings from the study sample. The formation of dimensions, indicators, and details to generate constructs from the tested variables was performed using factor analysis. Moreover, the analysis of these factors will form a new set of variables that are less numerous than those previously identified [38]. EFA aims to identify several measurement variables represented by each factor [41].

Therefore, the variables were not predicted through factor analysis, but it is a method to find the relationship between the whole set of variables as well as to find the strength of the relationship. EFA is performed before the CFA process in the instrument used to minimize variance differences and to identify the number of items required by each variable factor. The researchers can test the hypothesis of whether there is a relationship between the variables studied and the loading factor. CFA acted to validate the hypothesis and uses analytical diagrams for variables and factors [42]. Theoretical knowledge, empirical research, or both are used by researchers to obtain priority relationship patterns and then the hypothesis is tested using a statistical method [36], [43]. The model to be constructed contains dependent variables and independent variables in a model which is called a measurement model. The relationship between the 'dependent variable' and the 'independent variable' will be involved in this measurement model. These factors or constructs are also known as dependent variables and indicators are also known as independent variables. Indicators are items (questions) used in a questionnaire developed to detect independent or dependent variables [36], [43]. The loading produced after analysis is called measurement loading or factor loading.

3. RESULTS AND DISCUSSION

3.1. Respondents' background

Table 5 shows the demographic background of the respondents which consists of respondents' gender and race. A total of 87 (17.4%) male preservice teachers who participated in this study and the rest of the female preservice teachers who participated consisting of 413 people (86.6%). The breakdown of the

respondents was comprised of four races, consisting of: Malay with a total of 405 people (81.0%), Chinese with a total of nine people (1.8%), Indian with a total of six people (1.2%), Sabah Bumiputera with a total of 39 people (7.8%), and Sarawak Bumiputera with a total of 41 people (8.2%).

Table 5. Respondents' profile background

Profile of respondents		N	%
Gender	Male	87	17.4
	Female	413	82.6
	Total	500	100
Race	Malay	405	81.0
	Chinese	9	1.8
	Indian	6	1.2
	Sabah's Bumiputera	39	7.8
	Sarawak's Bumiputera	41	8.2
	Total	500	100

3.2. CFA of sustainability engagement and commitment in Eco-Campus activities of pre-service teacher

EFA results on the preservice teacher commitment measuring instrument to Eco-Campus engagement describing the anti-image correlation analysis procedure revealed that the value of the correlation coefficient was greater than 0.5, this indicates that factor analysis could be continued. The Kaiser–Meyer–Olkin (KMO) and Bartlett's test of sphericity sampling adequacy measurements obtained showed that the KMO value was 0.890, while the Bartlett's test sphericity was significant with the Chi-square value of 22793.031 at 780 degrees of freedom as presented in Table 6.

Table 6. Compatibility test of the use of factor analysis and KMO and Bartlett's test of item homogeneity

Kaiser-Meyer-Olkin	Measure of sampling adequacy	0.890
Bartlett's Test of Sphericity	Approx. Chi-Square Sphericity	22793.031
	df	780
	Sig.	.000

Factor analysis was performed with the researcher setting the number of factors to be extracted into four as categorized in the questionnaire. Table 7 shows the component matrix with varimax rotation. The varimax rotation method was performed because it can reduce the number of complex variables and can increase the expected results. As a result, it was found that items a8, a17, a20, and a40 were dropped because they had an 'anti-image correlation matrix' value of less than 0.5. While the values of a1, a2, a3, a4, a5, a6, a7, a9, and a10 belonged to component 1 which is knowledge, a11, a12, a13, a14, a16, a18, and a19 were accumulated under component 2 which is attitude, a21, a22, a23, a24, a25, a26, a27, a28, a29, and a30 belonged to group 3 which is participation, and a31, a32, a33, a34, a35, a36, a37, a38, and a39 were grouped under component 4 which is commitment. The values shown in Table 7 are the coefficients or load factors of each item that are inclined to each of the accumulated factors. These values indicate the correlation between the item and the factors formed and this is the key to understanding the nature of those factors.

Once the EFA was performed to group the items for the Eco-Campus engagement commitment construct, the CFA was conducted using AMOS 20 software to determine the first stage of confirmatory factor analysis model. Figure 3 shows the first stage of the CFA model of the students' Eco-Campus engagement commitment construct which has achieved good match accuracy. Figure 4 is a structural equation model of the students' Eco-Campus engagement commitment which is a combination of all dimensions of the students' Eco-Campus engagement commitment construct maintained in the first stage analysis. The model analysis formed in Figure 3 has achieved a good level of compatibility based on the indicators set in the final structural equation model of students' Eco-Campus engagement commitment (CMIN=464.155, DF=113, CMIN/DF=4.108, p=.000, GFI=.903, CFI=.960, TLI=.952, and RMSEA=.079).

Table 7. Component matrix with varimax rotation of sustainability engagement and commitment in Eco-Campus activities of pre-service teacher

Item	Component			
	Knowledge	Attitude	Engagement	Commitment
a1	.938			
a2	.929			
a3	.906			
a5	.841			
a4	.891			
a6	.859			
a7	.841			
a9	.506			
a10	.777			
a11		.759		
a12		.758		
a13		.781		
a14		.811		
a16		.714		
a18		.716		
a19		.770		
a21			.827	
a22			.836	
a23			.842	
a24			.793	
a25			.841	
a26			.870	
a27			.846	
a28			.741	
a29			.688	
a30			.684	
a31				.812
a32				.871
a33				.772
a34				.821
a35				.613
a36				.745
a37				.884
a38				.758
a39				.735

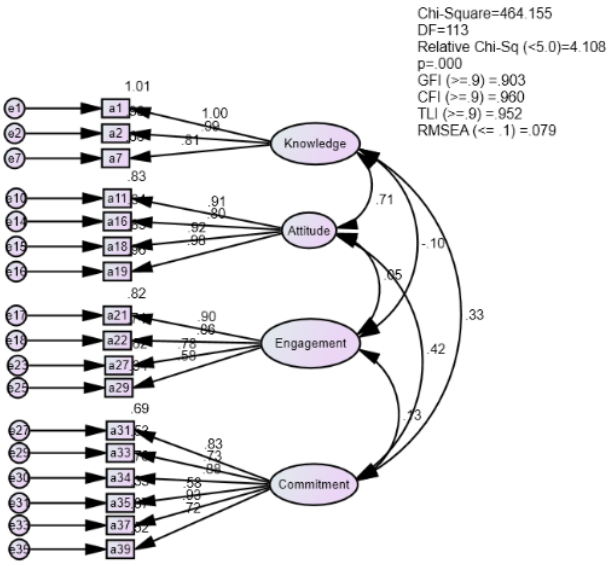

Figure 3. The first stage of confirmatory factor analysis model of sustainability engagement and commitment in Eco-Campus activities of pre-service teacher

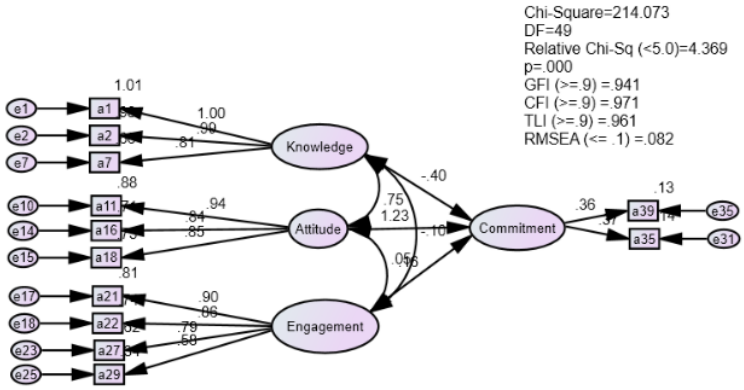

Figure 4. Structural equation model of sustainability engagement and commitment in Eco-Campus activities of pre-service teacher

Figure 4 shows that the built model has reached a good level of compatibility based on the indicators set out in the final structural equation model of students' Eco-Campus engagement commitment (CMIN=214.073, DF=49, CMIN/DF=4.369, p=.000, GFI=.941, CFI=.971, TLI=.961, and RMSEA=.082). Thus, the items and the structural equation model of Eco-Campus engagement commitment of pre-service teacher was able to be used to measure students' Eco-Campus engagement commitment as per the conditions set [36], [44], [45]. The model produced was in line with the elements contained in the Environmental Education Commitment Model [25]. Only four variables were selected in this study, namely knowledge, attitude, engagement, and commitment compared to the proposed model which covers other elements such as life experience, beliefs, and norms. However, knowledge, attitude, and engagement are correlated with each other (Figure 3) and each contributes to Eco-Campus engagement commitment (Figure 4). This coincides with theory by [19]; theory of planned behavior [20]; life-span developmental theory [21].

4. CONCLUSION

The results of EFA and CFA in this research showed that convergent validity and discriminant validity have been achieved. The EFA results showed that there were four components of Eco-Campus engagement commitment of pre-service teacher that had been generated, namely the knowledge, attitude, engagement, and commitment components. In addition, through this analysis, there were items that had been dropped where out of the 40 initial items constructed by the researcher, a total of four were dropped to get a good matching index. The values of compatibility of CMIN=214.073, DF=49, CMIN/DF=4.369, p=.000, GFI=.941, CFI=.971, TLI=.961, and RMSEA=.082 were in accordance with the predetermined conditions. Overall, the model of sustainability engagement and commitment of pre-service teacher in Eco-Campus activities formed from this CFA method can be used to determine and measure the level of knowledge, attitude, engagement, and commitment of students.

The production of this instrument of sustainability engagement and commitment of pre-service teacher in Eco-Campus activities through the model generated in the CFA process among UPSI student respondents also seems fitting because these students will go on to share campus eco-information as administrators, thinkers, educators. In fact, this model helps the community to take proactive steps in implementing environmental studies. It also assists in the development of models or early studies of youth in protect the environment in Malaysia or countries with similar demographics towards achieving sustainable development goals.

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