The Confirmatory Factor and Measurement Model Analyses of Perceived Restorativeness Scale (PRS) in Malaysian Context

El factor confirmatorio y los análisis del modelo de medición de la escala de restauración percibida (ERP) en el contexto de Malasia

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ABSTRACT

There is a significant association between students' lower psychological well-being and their academic performance. Therefore, in order to discover the ways of relieving students' emotional disturbance and negative health condition, more research is needed for the improvement of their psychological well-being especially through exposure to nature as a restoration method upon facing negative emotions. This paper aims to validate and gain access to the reliability of Perceived Restorativeness Scale (PRS) among students. A cross-sectional study was conducted in this research on a sample taken from undergraduate students (N = 390). For explanatory factor analysis (EFA) with SPSS, respondents participated in an online survey. As for confirmatory factor analysis (CFA), AMOS programme was used for the measurement of model. A total of 26 items had been separated into four sub-constructs of PRS were used. Subsequently, an excellent structure was displayed by the revised PRS, with good factor loadings and sufficient convergent validity. Ultimately, the cut off requirements were fulfilled. Overall, it was revealed that the internal consistency of the alpha values was α = 0.967, with the values of individual sub-constructs reliability are as follows: compatibility (0.927), coherence (0.883), fascination (0.950), and being away (0.895). It was found that PRS possessed an acceptable level of internal consistency. Besides, validity and reliability were discovered in the items for measurement of the intention instrument according to the selected pooled sample.

Keywords: Confirmatory Factor Analysis, Emotional Disturbance, Perceived Restorativeness Scale, Undergraduate Students.

RESUMEN

Existe una asociación significativa entre el bajo bienestar psicológico de los estudiantes y su rendimiento académico. Por lo tanto, para descubrir las formas de aliviar el trastorno emocional y el estado de salud negativo de los estudiantes, se necesita más investigación para mejorar su bienestar psicológico, especialmente a través de la exposición a la naturaleza como método de restauración al enfrentar emociones negativas. Este documento tiene como objetivo validar y obtener acceso a la confiabilidad de la Escala de Restauración Percibida (PRS) entre los estudiantes. Se realizó un estudio transversal en esta investigación en una muestra tomada de estudiantes de pregrado (N = 390). Para el análisis factorial explicativo (EPT) con SPSS, los encuestados participaron en una encuesta en línea. En cuanto al análisis factorial confirmatorio (CFA), se utilizó el programa AMOS para la medición del modelo. Se utilizó un total de 26 ítems separados en cuatro subconstrucciones de PRS. Posteriormente, el PRS revisado mostró una estructura excelente, con buenas cargas de factores y suficiente validez convergente. Finalmente, se cumplieron los requisitos de corte. En general, se reveló que la consistencia interna de los valores alfa era α = 0.967, con los valores de confiabilidad de subconstrucciones individuales que son los siguientes: compatibilidad (0.927), coherencia (0.883), fascinación (0.950) y estar lejos (0.895). Se encontró que PRS poseía un nivel aceptable de consistencia interna. Además, se descubrió la validez y la confiabilidad en los ítems para la medición del instrumento de intención de acuerdo con la muestra agrupada seleccionada.

Palabras clave: Análisis factorial confirmatorio, alteración emocional, escala de restauración percibida, estudiantes de pregrado.

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1. INTRODUCTION

Positive psychological well-being is described as positive well-being in the physical, mental, and social aspect, besides being free from disease (WHO, 2013). However, there have been reports on the significant increase of issues associated with mental health, which is by 15% by 2020. Furthermore, young people are the group who has been facing the highest risk to this problem (WHO, 2008). Therefore, a number of methods of relieving negative emotions were recommended by studies from the past. Examples of such methods are identity group intervention (Eichas et al., 2017), well-being therapy (Fava et al., 2017), mindfulness-based group interventions (Josefsson, 2014), instilling spiritual values (Huguelet et al., 2016), and yoga (Rani et al., 2012). Continuous emphasis is put on these types of activities in the field of research for the improvement of one's psychological well-being. However, in the literature's point of view, appeared that exposure to nature is described as an element of emotional disturbance reduction and psychological restoration. For the improvement of health, this form of relief is studied in further detail and suggested (Eko, 2015; Berto, 2014; Bakar & Ishak, 2014; Beyer et al., 2014; Maller et al., 2009; Mitchell & Popham, 2007).

Perceived Restorativeness Scale (PRS) instrument, which consists of 26 items included into four dimensions which are compatibility, coherence, fascination, and being away, can be used for measurement of the dimension of restoration (Hartig et al., 1997). Originated from the theory-based introduced by Kaplan & Kaplan (1989), upon the expectation that an individual obtains their restorativeness during exposure to nature, those four features fall under Attention Restoration Theory. Studies from the past have found that fascination is a dominant factor which influences the quality of perceived restorativeness. For that reason, the main objectives of this study are to conduct an overall overview of the used variables, and to investigate the reliability and validity through measurement model and confirmatory factor analysis of perceived restorativeness scale.

Perceived Restorativeness in Nature

It has been reported that students' daily lives are heavily affected by high-demand activities, namely spending time on studying, having assignment and presentations done, attending classes, sitting for examinations, final year project, financial issues, social life and communication problems. These activities have negatively impacted the students' emotional disturbance and mental health in their academic journey (Song & Lindquist, 2015; Regehr, Glancy & Pitts, 2013; Byrd & McKinney, 2012; Elias et al., 2011). This disorder starts with stress, which occurs in our daily lives. However, when this condition becomes worse, it can lead to anxiety and depression. Due to low cognitive and psychological ability, this extent of emotional disturbance may be detrimental to students' mental health (Bakar & Zakaria, 2018; Kaplan, 1989). To put this differently, student's learning process, focus, and task performance will be negatively affected by poor psychological well-being and unstable mental state.

Therefore, restoration approach can be implemented in maintaining positive mental health and psychological well-being. The purpose of this method is so that students are able to manage the psychological challenges which are present in their surroundings through the replenishment of "psychological resources" (Hartig, Kaiser & Bowler, 2001). Various factors and environmental settings can contribute to this replenishment, as they function as the psychological resources which would aid with psychological well-being and relieve negative emotions. Moreover, the availability of the resources is more than enough to aid individuals in countering more problems. It has been found by studies from the past that physical activities (Hug et al., 2008; Ussher et al., 2007; Biddle, Fox & Boutcher, 2003), participation in social events (Sandstrom & Dunn, 2014; Lakey & Orehek, 2011; Rosenbaum, Sweeney & Windhorst, 2009), and nature viewing (Howell et al., 2011; Nisbet, Zelenski & Murphy, 2011; Matsuoko, 2010; Ulrich, 1984) can aid with psychological restoration. Even so, it has also been found that more positive outcomes can be obtained through nature viewing and exposure to nature as a restoration method, on both psychological and physiological functioning of a human's body (Gatersleben & Andrews, 2013; Karmanov & Hamel, 2008). These also enhance the mental performance of humans (Berman et al., 2008) and contribute to more positive feelings. More positive feedback has been reported regarding the students' overall learning experiences (Benfield et al., 2015).

The idea of exposure to nature for perceived restorativeness is in accordance to the Attention Restorative Theory (ART). In this theory, it is claimed that the concentration ability of humans improves after the time spent being exposed to nature, or just observing nature (Kaplan & Kaplan, 1989). Therefore, frequent mental fatigue which is experienced by most people especially students can be relieved through exposure to nature or green space. Besides, interaction with nature enhances cognitive performance which revolves around attention recovery is the primary idea of this theory (Kaplan, 2001). In addition, there are four features proposed by ART, which add up to as restorative element in the environment namely being away, extent, fascination, and compatibility.

The first feature is being away, which describes on individuals' desire for a getaway from typical environments such as the academic, domestic, and office environment. However, only by being away from such demanding and tiring environment would not guarantee restorative effects on individuals. Therefore, consideration should be placed on the second feature, which is extent. In order to obtain a restorative environment, this feature is necessary. Extent describes how individuals are associated with the environment of their liking, which adds to more positive outcomes on them. This is followed by the third feature, which is fascination. It is defined by the need to look at something where, instead of the typical

demanding attention, effortless attention is given. Next, the fourth and last feature is compatibility. This describes the compatibility of individuals in "the environmental patterns, individual's tendency and the actions needed for the environment" (Kaplan, 1992). It is important that all of these features of a restorative environment are emphasized when a place to relax and revitalize mental performance is being decided, especially in natural setting.

2. METHODOLOGY

Participants and procedure

In the current study, a cross-sectional study was adopted in order to examine the Perceived Restorativeness Scale (PRS), in the aspect of its validity and reliability. This was followed by collection of empirical data from undergraduate students from 16 different faculties in the university. Names and email addresses of the students were provided by the university's Academic Centre. From that information, participants of this study were selected by random. Then, the self-administrated questionnaire of this study, which consisted of 26 questions from the undergraduate students' in Universiti Putra Malaysia, were distributed online through google drive link. This link was sent to those email addresses. As a result, out of the 1500 names and emails who received the questionnaires, 390 of them responded. Specifically, they consisted of females (n = 306, 78.5%) and males (n = 84, 21.5%) who aged from 21 to 25 years old.

Instruments

The instruments used in this study were separated into four dimensions or sub-constructs of Perceived Restorativeness Scale (PRS) (Hartig et al., 1997). These four sub-constructs consist of compatibility (9 items), coherence (4 items), fascination (8 items), and being away (5 items). Reversing and recording of the negative instruments were conducted before data analysis. 7-point Likert response scales, which ranged from 0 (strongly disagree) to 6 (strongly agree). Two phrases were used in the questionnaires, which are: 1) "This place has fascinating qualities", and 2) "Being here helps me with my focus on getting things done". The Cronbach's alpha values for the subscale of being away, fascination, coherence, and compatibility were 0.895, 0.950, 0.883, and 0.927 respectively. Subsequently, the overall value for Cronbach's alpha coefficient in this study was 0.834. There was an alignment between this study and several previous studies in terms of the values of reliability, where they amounted higher than 0.78 (Hartig et al., 1997), 0.94 and 0.95 (Pasini et al., 2009; Berto; 2007) for the being away, fascination, coherence, and compatibility subscale respectively.

Data Analysis

In computing the descriptive analysis, the statistical tool of SPPS version 23 was used. Meanwhile, for the reliability and validity analysis, confirmatory factor analysis and measurement model with Structural Equation Modelling-AMOS version 21was utilized (Abuckle, 2005).

3. RESULT AND DISCUSSION

Descriptive Analysis

It can be seen from the findings that fascination sub-construct (M = 4.558, SD = 0.886) exhibited the highest overall mean. This is followed by the being away sub-construct, with the second highest overall mean (M = 4.510, SD = 0.972). The sub-construct with the third highest overall mean was coherence (M = 4.472, SD = 0.916). This is followed by the overall mean for compatibility (M = 4.261, SD = 0.892). The item with the most significant relation to perceived restorativeness was "The setting is fascinating" (M = 4.680, SD = 1.042). This item fell under the fascination sub-construct. Meanwhile, the item with the least significant relation to perceived restorativeness was "I have a sense of belonging here" (M = 4.000, SD = 1.349) in the compatibility sub-scale.

Measurement model: Confirmatory Factor Analysis (CFA)

In examining the validity and reliability of the measurement model with SEM-AMOS analysis, a two-stage approach was used. Assessment of measurement model was conducted through confirmatory factor analysis (CFA), with analysis on maximum likelihood estimation method. In this analysis, investigation specifically on the goodness-of-fit indices, along with the construct validity and reliability was performed. In this approach, whether the expectations model were fulfilled by the loading of measured (indicator) variables on factors and the number of factors was taken into account (Kline, 2004). Separate analysis was performed on each of the constructs in a separate measurement model. Apart from that, for the measurement of each underlying factor, the evaluation of uni-dimensionality was employed, which was done through examination of the goodness-of-fit indices statistical result.

The measurement of CFA model was conducted in accordance to the perceived restorativeness construct. This construct comprises of four (4) sub-constructs, specifically being away, fascination, coherence, and compatibility. The measurement of 26 items in total and each sub-construct was conducted using different overall amount of instruments. Based on the results, it was shown that due to lower factor loading, one item under being away sub-construct, specifically PR4ba, was removed from the overall five items. Next, under fascination sub-construct, eight items not being removed. Even so, it was found that one item, specifically PR14coh, had to be eventually removed from the coherence sub-construct due to lower factor loading. Finally, it was also found that removal of

item PR18com, PR23com, and PR26com was performed from nine items under the compatibility sub-construct due to lower factor loading. This was due to the identification of the aforementioned items as having poor measure of the latent construct. To illustrate this, as for inter items with correlation value above 0.7, removal from subsequent model development for parsimony would be done on factor loadings with values lower than 0.3 (Kline, 2005).

After item removal was performed, the values of the modification indices (MI) of the measurement model's fit was produced, which were $\chi 2$ (177) = 497.109, p = 0.00, $\chi 2$/DF = 2.809, GFI = 0.888, CFI = 0.958; IFI = 0.958, TLI = 0.950, RMSEA = 0.068. Upon further data investigation, the value of institutional factor composite (CR) was found to range from 0.883 to 0.949. Meanwhile, the range of the value for AVE was found to be from 0.699 to 0.716. In the results, all factor loadings for perceived restorativeness construct are shown to be higher than 0.5, as presented in Table 1. Therefore, the value of the internal consistency (alpha) for all constructs was higher than 0.7, the cut off value for study sample (DeVellis, 2011; Nunnally & Bernstein, 1994). For that reason, the reliability of the constructs within the sample study was sufficient (Bakar et al., 2017; Hair et al., 2010).

Table 1: Items loading factor in final fit of the measurement model for Perceived Restorativeness Scale (PRS)

Construct	Item	Loading Factor		Cronbach's Alpha	CR	AVE
		Initial	Modified			
Being away	PR5ba	0.838	0.803	0.895	0.904	0.703
	PR4ba	0.789	del**			
	PR3ba	0.881	0.873			
	PR2ba	0.827	0.856			
	PR1ba	0.760	0.817			
Fascination	PR13fas	0.869	0.872	0.950	0.949	0.699
	PR12fas	0.866	0.876			
	PR11fas	0.872	0.880			
	PR10fas	0.882	0.882			
	PR9fas	0.833	0.820			
	PR8fas	0.798	0.779			
	PR7fas	0.764	0.741			
	PR6fas	0.841	0.829			
Coherence	PR17coh	0.808	0.830	0.883	0.883	0.716
	PR16coh	0.857	0.889			
	PR15coh	0.813	0.817			
	PR14coh	0.731	del**			
Compatibility	PR26com	0.771	del**	0.927	0.927	0.681
	PR25com	0.826	0.788			
	PR24com	0.671	0.614			
	PR23com	0.727	del**			
	PR22com	0.871	0.899			
	PR21com	0.856	0.886			
	PR20com	0.854	0.866			
	PR19com	0.852	0.860			
	PR18com	0.822	del**			

**del – higher in residual variance, *del – lower in factor loading

In assessing the comparison between each construct in terms of the root of AVE against the correlation between the models, discriminant validity was carried out. Hair et al., (2010) highlight that provided the exceeding AVE's square root beyond the correlation among the constructs, construct will have sufficient discriminant validity. Following that, the result of AVE's square root for each sub-construct is displayed in Table 2 below. Based on this table, the value of the square root is higher than the value of each correlation between subscales. Therefore, the amount of discriminant validity for all subscales is adequate.

Table 2: Correlation of latent variables and discriminant validity of Perceived Restorativeness Scale (PRS)

Constructs	ba.	fas.	coh.	com.
Being away	**0.838**			
Fascination	0.835	**0.836**		
Coherence	0.751	0.778	**0.846**	
Compatibility	0.738	0.766	0.786	**0.825**

Note: ba. – being away, fas. – fascination, coh. – coherence, com. - compatibility
Squared Roots of AVE (on the diagonal)

Correlation coefficient (on the off-diagonal)

Measurement model analysis: Second 2-order

The data examination in this study was followed by the final analysis. This analysis took place after the validity and reliability required for the respective instruments to acquire the model fitness. The final measurement was conducted through examination on the second-order factor from the latent variable (Hair et al., 2010). A fit model is positive when it fulfils the following requirements: a high chi-square (2) value, the range of 1 to 5 for the normal chi-square, Incremental fit index (ILI), Adjusted goodness of fir index (AGFI), comparative fit index (CFI), the goodness of fit index (GFI), and the values of Tucker-Lewis (TLI) being higher than 0.9, while the values of root mean square error of approximation (RMSEA) being not higher than 0.08 (Hair et al., 2010). Therefore, it could be seen from the finding that the model's fitness in the data in an acceptable threshold level was indicated by the second order $\chi 2$ (179) = 510.815, p = 0.00, $\chi 2$/DF = 2.854, GFI = 0.888, CFI = 0.957, TLI = 0.949, RMSEA = 0.067. Moreover, the values of the modification indices (MI) of the goodness-of-fit indices displayed went beyond the cut-off value at a significant degree, as shown in Figure 1.

Calculation of the measurement models was performed for each of PRS constructs, namely being away, fascination, coherent and compatibility, towards exposure to nature. With this process, measurement error, where significant indicators of each construct are maintained, would be decreased. Therefore, identification can be made on this measurement error indicator in the full measurement model (Byrne, 2013). With the summary of the results above, the positive fitness of PRS as a data in the sample selected for the undergraduates for this study could be confirmed. For that reason, PRS can be used upon exposure to nature as a measurement method for the acceptance of restorativeness in the area of this study. In general, a good fit of sample for the pooled study was displayed from the covariance process between measurement models, along with the removal items in the sub-constructs. Following this step was the evaluation of convergent validity, discriminant validity and reliability in order to assess whether the psychometric properties were met and sufficient.

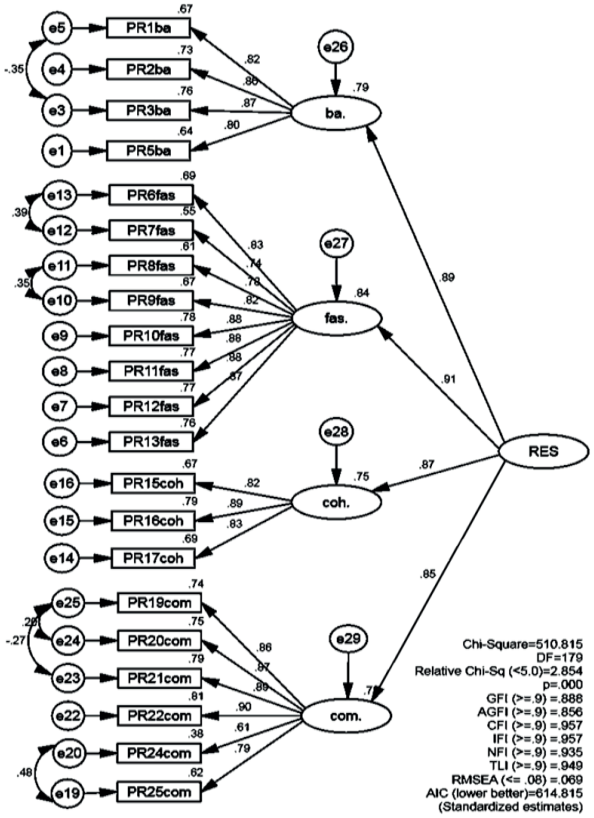

Figure 1: Modified measurement model of Perceived Restorativeness Scale (PRS)

4. DISCUSSION

This study aims to provide the PRS instruments with validation (Hartig et al., 1997) on undergraduate university students as the sample, particularly on the exposure to nature for stress relief. With the PRS, an alternative is available for researchers in the future to use for restoration upon exposure to nature. Furthermore, the evaluation of stress relief upon exposure to nature based on respondents' point of view is displayed in this study's result. Based on the result, support was provided to the original 4 sub-constructs of PRS.

Based on the results of CFA, the data's fitness in the model was indicated. This provides support to PRS, where exposure to nature as stress relief is evaluated. It was also indicated in CFA's modification indices that removal from the measurement model needed to be performed on many indicators. Examples of those indicators were the following indicators of particular sub-constructs, namely PR26com, PR23com, PR18com, PR14coh, and PR4ba. The influencing factor of this removal is the high covariance between measurement errors. This is followed by the high regression weights between these error constructs. This indicates a refinement process, where examination is conducted on. Eventually, it has been proven that it is acceptable as an instrument, in terms of accessing to the perceived restorativeness towards environment in regards to natural environment setting. Besides, for access to any respective model, the measure of goodness-of-fit as fit indices is necessary, as proposed in this study (Kline, 2011; Hair, 2010).

Similar studies from the past (Eko, 2015; Pasini et al, 2014; Hartig et al., 2003), empirical and theoretical support are provided in this study in order to validate PRS as an appropriate framework. The purpose of this is to obtain further comprehension on student's acceptance of stress relief methods for improved psychological well-being and academic performance.

5. IMPLICATIONS OF THE STUDY

Several implications for practice, methodology, and theory have been discovered in this study. On the theoretical perspective, it is illustrated in this study that despite the proper functioning of the measure, there has been further decrease of natural resources, plant, and vegetation as a result of urbanization. Moreover, a number of studies where those three factors are focused on are included into this study, and the importance of those factors in mental health acceptance is emphasized.

In the methodological point of view, the purpose of CFA is to investigate the association between the sub-constructs of PRS instruments. Therefore, this study has provided positive outcomes to the trend of research on the exposure to nature. Therefore, the use of the second generation of multivariate, where its techniques are distinguished from the techniques of the first-generation such as regression, discriminant analysis, and factor analysis, will be emphasized (Gefen et al., 2000).

In the practical perspective, it has been indicated from the results that students had the consciousness and precaution in the role of nature for stress management (Ward Thompson et al., 2016; Berto, 2014; Fan et al., 2011). With this finding, the quality of life particularly in terms of emotional disturbance will be enhanced for the improvement of both components of attention, as highlighted in the Theory of Attention Restorative Theory (Kaplan & Kaplan, 1986). Generally, with the PRS instruments, researchers are capable of assessment and comprehension on how much response would be given by users to restoration. Besides, these instruments contribute to assessment and evaluation on how far alternative instruments are provided by users in measuring students' perceived restorativeness on nature in order to relieving stress or other emotional disturbances such as depression and anxiety for improved psychological wellbeing (Ahmad et al., 2018; McEachan et al., 2016; Bratman et al., 2015a; Song et al., 2015; Beyer et al., 2014)

As a result, this study aims for a better comprehension or respondents' point of view regarding restoration in acknowledging nature as a means of improving psychological well-being and academic performance (Surat et al., 2018; Wu et al., 2014; Matsuoka, 2010; Taylor & Kuo, 2006). Furthermore, further implications are provided by this study to educational stakeholders for comprehension and more alternatives to contemporary techniques to be provided in the effort of relieving stress.

6. CONCLUSION

In order to acquire greater generalizability of the PRS, future study is necessary for further validation on the instrument. Besides, the instrument should be used in the proposed model in various settings, on different respondents with different social and cultural backgrounds. Through investigation in various backgrounds and settings, the comparison against other identical measures from the point of view of restoration towards exposure to nature will be justified. Besides, more rectified indicator to the information associated with psychometrics can be produced with this justification. Subsequently, various dimensions and further comprehension on the factors behind respondents' reaction and different perceptions regarding nature can be obtained.

Structural Equation Modelling (SEM) was used in this study in investigating a series of associations between the dependent (endogenous) and independent (exogenous) variables (Ho, 2006). Therefore, with SEM, estimation of multiple dependence relationships is allowed. This is where latent variable in model is incorporated and definition

of model is made in order to illustrate the association between the constructs (Hair et al., 2010). Additionally, SEM will assist in the investigation on the causal relationship through series of structural equations. It will also facilitate the clarification of the theory study's concepts (Byrne, 2013) through examination on the structural and measurement model (Schumacker & Lomax, 2010).

Subsequently, modification was conducted on the model through the procedures in accordance to the constructs selected from the designed objectives. For this reason, confirmatory factor analysis (CFA) was used. This is an approach where whether the loading of measured (indicator) variables on factors and the number of factors fulfil the expectations is taken into account (Kline, 2004). Moreover, separate analyses were performed on the constructs in a separate measurement model. The evaluation of uni-dimensionality was employed for measurement of each underlying factor through examination on the statistical results of the goodness-of-fit indices.

Future studies should be performed in order to obtain greater generalizability of the PRS. This would provide further validation of the instrument. Besides, the use of the instrument will be performed in the proposed model across various settings, and different respondents with different social and cultural backgrounds. Through studies conducted in various backgrounds and settings, the comparison against other similar measures in the point of view of restoration towards exposure to nature will be justified. With this, more rectified indicator to information associated with psychometric will be provided. Consequently, different dimensions and further understanding on the factors of respondents' reaction and different perceptions of nature will be acquired.

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