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INVESTIGATING THE RELATIONSHIP BETWEEN NATURE-RELATEDNESS AND MENTAL HEALTH IN YOUNG VIETNAMESE ADULTS: A STRUCTURAL EQUATION MODELLING APPROACH*

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Nature-based interventions for youth's mental health are becoming common. More empirical evidence is needed to support policymaking in schools and communities due to the limited studies on young individuals. This study aims to test a structural model to examine the role of nature-relatedness on subjective positive well-being (life satisfaction) and mental disorders (depression, stress and anxiety) in Vietnamese young adults. A set of questionnaires was completed by 515 university students (M_{age} = 19.30, SD = 0.69). The used measurements were the Nature Relatedness Scale, the Depression, Anxiety and Stress Scale (DASS-21) and the Life Satisfaction Scale. The Vietnamese version of the Nature Relatedness Scale was validated as a previous step. The structural model demonstrated fit (χ^2/df = 1.23, CFI = .97, RMSEA = .07, SRMR = .03). According to path analysis results, NR-Self was associated with greater life satisfaction with lower stress and lower depression. However, the

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NR-Perspective was associated with lower life satisfaction, and higher levels of stress, anxiety and depression. NR-Experience also unexpectedly significantly predicted depressive symptoms. Results were interpreted in the light of the related literature; acknowledgement of limitations and future research directions were also discussed.

Keywords: life satisfaction; mental health; nature-relatedness; students; youth

The rapid speed of urbanization globally has led to an increase in the world population disconnecting from nature (Bratman et al., 2012). Many people, especially youth, are now living a life without any relevance to nature which leads to a higher risk of having adverse impacts on their mental health (Gascon et al., 2016). According to the World Health Organization (WHO, 2014), adolescents and young adults have a life period of the highest risk of experiencing mental illness. There have been increasing statistics of depression, anxiety, stress and suicide among youth (WHO, 2014) that negatively affect their learning and daily lives (Cooley et al., 2007).

Evidence in history has shown that nature can reduce mental illness (e.g. stress, anxiety and depression) and increase life satisfaction (Cox et al., 2017), which are considered negative and positive indicators of mental health (Bratman et al., 2012). People who spend time with plants or nature-connectedness have lower symptoms of negative emotions and report more positive feelings than those who exposure time in an artificial environment (Lovell, 2016). Many basic and intervention studies show that cognition, learning abilities and well-being of youth improve significantly through interaction with nature (Bloomfield, 2017; Nisbet, 2014). In particular, a "natural medicine" or "Vitamin Nature-Vitamin N", gradually become familiar, listed as a "prescription", a psychotherapy that supports young people with mental health problems, such as stress, anxiety, depression, or attention deficit hyperactivity disorder (Gilles, 2020). However, some other studies conducted on youth revealed that nature-relatedness is more likely to correlate with positive health indicators than negative mental health indicators. In other words, nature-relatedness may have a more important role in promoting happiness than reducing negative psychological health (e.g. stress, anxiety and depression). Overall, young adults who scored higher on the level of nature-relatedness were more likely to report higher levels of well-being, such as enjoying pleasure, reducing sorrow, finding meaning in life, being satisfied with life (Nisbet et al., 2011) and psychological health, such as self-actualization and realization of personal potential (Howell et al., 2011). Most of these mentioned studies did not find

a relationship between nature-relatedness and negative emotions. Therefore, further studies are needed to clarify this connection.

Although there is a conflict in some studies about the existence of a correlation between nature-relatedness and mental illness, studies related to the connection with nature in young people should be encouraged around the world. Findings from these studies make an essential contribution to laying a solid scientific foundation for the application of natural therapies in the treatment and prevention of mental disorders in youth. Many governments and non-government organizations are now considering the potential benefits of nature-connectedness in their developmental programs and policies (Department of Health, 2010; U.S. Department of the Interior, 2011). However, the majority of studies have been conducted with Western samples, mainly in Canada and the USA. (e.g., Bloomfield, 2017; Nisbet et al., 2011).

In Vietnam, along with urbanization, nature is more divided and gradually disappears from the city. Young people seem to have no outdoor space to play. Nature deficiency disorder syndrome (Nature-deficit disorder) – when people are spending very little time outdoors and this change is thought to lead to a range of behavioural and emotional problems – is becoming increasingly apparent and common among young Vietnamese. Some studies reveal that awareness, attitude, and capacity to protect the environment as well as the level of connection to nature in Vietnamese students are insufficient (Nguyen & Nguyen, 2022). Besides, it is estimated that there are at least three million youth in Vietnam who experience mental health problems. However, only 20% of these receive medical and basic treatment (UNICEF, 2023). The application of nature-based intervention programs potentially promises to improve mental health among students in Vietnam. However, we need more empirical support for evidence-based implementation. This study, therefore, aims to contribute to knowledge about the correlation between nature-relatedness, and mental health problems when accounting for socio-demographic characteristics. This study's findings provide evidence for educational policymakers to improve students' mental health by integrating experiential activities with nature in school curricula such as Biology, Literature, Physical Education, and Psychology. Extracurricular activities for students such as local outdoor events related to environmental protection to raise awareness, attitudes and experiences with nature.

METHOD

Participants

This is a cross-sectional, school-based study conducted on 534 first-year, second-year, and third-year students from the University of Education, Hue University. There were 515 completed questionnaires (response rate 96.4%), of which 89.5% of them were females. The mean age was 19.30 (*SD* = 0.69).

Procedure

Ethical approval for this study was obtained as part of project T.20 – XH.SV – 04, funded by University of Education, Hue University, Vietnam. The study's ethical framework was reviewed and recognized by designated university committees (as per Decision No. 267/QĐ-ĐHSP, issued by the Rector on February 27, 2020, concerning the research proposal, and Decision No. 1055/QĐ-ĐHSP, issued by the Rector on June 8, 2022, concerning the final report).

Four departments were randomly selected, including the Department of Psychology, Department of Mathematics, Department of Preschool Education and Department of Elementary Education. In each department, two to three classes were randomly selected. All students in selected classes were invited to participate in the study. The surveys were conducted during school time in the first semester of the school year.

On the survey date, trained research assistants explained the purpose of the study and the responsibility and rights of participants to students. Opt-out consent was applied and explained. If respondents answered and returned the questionnaires to the research assistants, they agreed to be in the study. Otherwise, they did not need to complete the questionnaire but did their private work during class time and then returned the blank questionnaire to the research assistants as other students. Confidentiality of the answers was emphasized to all students. All questions raised by the students were answered. Then, students completed the questionnaire voluntarily and quietly in approximately 20–30 minutes. The lecturer was asked to be outside of the class. The research assistant gave the students enough private space to complete the questionnaire while still available to answer any questions related to the questionnaire.

Measures

The dependent variables were mental health problems and satisfaction with life. The 21-item Depression, Anxiety and Stress Scale (DASS-21) (Lovibond & Lovibond, 1995) was used to investigate symptoms of mental health problems among university students. The scale includes 21 items measuring three separate symptoms with seven items for each: depression, anxiety and stress. The scale yields three scores accordingly. Scores of each subscale were gained by summing all its seven relevant items and then duplicating them. The range score, therefore, for each item was from 0 to 42. The higher the score, the higher the level of depression, anxiety or stress (Lovibond & Lovibond, 1995). The three-subscale score of the DASS-21 has been validated for use among adolescents and adults in Vietnam with high internal consistency (Cronbach's alpha ranged from .70 to .91) (Le et al., 2017; Tran et al., 2013). In this present study, the Cronbach's alpha of depression, anxiety and stress subscales were .80, .74 and .75, respectively and of the full scale was .89.

Satisfaction with life was measured by the 5-item Satisfaction with Life Scale (SWLS) which is a 5. Each item uses a 7-point scale that ranges from 7 (*strongly agree*) to 1 (*strongly disagree*). The satisfaction with life score is calculated by summing all 5 items. The maximum score is 30. The higher the score, the higher the level of satisfaction (Diener et al., 1985). This scale has been widely used globally (Ruiz-Aranda et al., 2014; Yun et al., 2019). The validity and reliability of the Vietnamese-translated version were demonstrated in previous Vietnamese studies by Nguyen (2020) and Nguyen et al. (2020). The Cronbach's alpha of the SWLS in this present study is .70.

The independent variables were nature-relatedness dimensions/components. The level of connecting to nature was identified by using the Nature Relatedness Scale introduced by Nisbet et al. (Nisbet, 2008). The scale includes 21 items and measures three separate aspects related to the connection between humans and nature: Nature-Relatedness-Self (NE-Self), Nature Relatedness-Perspective (NR-Perspective) and Nature Relatedness-Experience (NR-Experience). The first subscale includes eight items such as "I feel very connected to all living things and the earth". The second subscale includes seven items, such as "Humans have the right to use natural resources any way we want". The third subscale includes six items, such as "I enjoy being outdoors, even in unpleasant weather". Each item uses a five-point Likert scale ranging from 1 (*disagree strongly*) to 5 (*agree strongly*). The score of each subscale is the average of appropriate items after reversing the scores of

some items. The higher score is indicative of a stronger connection to nature (Nisbet, 2008).

The Vietnamese version of the Nature Relatedness Scale was validated among Hue University students (Nguyen & Nguyen, 2022). However, in this version, up to seven items were removed to obtain model fit. Therefore, based on their suggestions, we modified the translation and implemented the Confirmatory Factor Analysis (CFA). The result of CFA indicates that a three-factor model fitted the data acceptably after removing 4 problematic items with factor loadings <.30 (i.e., item 2 = .13; item 9 = .12; item 10 = .10 and item 13 = .10) with normed χ^2 =2.01; CFI =.90; RMSEA = .05; SRMR = .05 (Hu & Bentler, 1999). Cronbach-alpha reliability coefficient of the full NR scale is found as .78; Cronbach-alpha reliability coefficient of NR-self, NR-perspective and NR-experience is found respectively as .74, .61, and .62. The average inter-item correlation ranges from .15 to .50 as well as the average item-total correlation is over .35 (Nunnally & Bernstein, 2010). Nunnally and Bernstein also indicate that newly developed or adapted measures can be accepted with an alpha value of .60, otherwise, .70 should be the threshold. All these indices help demonstrate acceptable validity and internal consistency of this Vietnamese-translated version of the scale.

Data Analysis

Descriptive statistics were used to understand the distribution of each variable with the support of the Statistical Package for the Social Sciences (SPSS).

Statistical analyses were conducted using structural equation modelling (SEM) to test a measurement model and a structural model to examine the role of nature-relatedness on mental disorders (depression, stress and anxiety) and positive well-being (life satisfaction).

Given the presence of missing values, and to avoid interpretive problems related to the normality of the data, the Mplus 8.1 with maximum likelihood estimation is used to estimate the confirmatory and structural equation models in this study. Similar to the above report, for the model estimated, we would report the following recommended goodness-of-fit indices: normed $\chi^2 < 2$; comparative fit index (CFI > .90); root mean square error of approximation (RMSEA < .08), and (SRMR < .08 (Hu & Bentler, 1999).

RESULTS

Preliminary Analyses

Means, Standard Deviations and Pearson product correlations among variables included in the current study are presented in Table 1.

Table 1
Descriptives and Correlations Among Study Variables

	M	*SD*	2	3	4	5	6	7
Nature-relatedness								
1. NR-Self	3.85	.51	.49**	.12**	−.13**	−.03	−.15**	.24**
2. NR-Perspective	3.99	.49	1	.06	.21**	.11**	.12**	−.14*
3. NR-Experience	2.48	.65		1	.17**	.00	.09	.09
Mental Illness								
4. Depression	0.78	.49			1	.64**	.70**	−.30**
5. Anxiety	0.93	.50				1	.72**	−.21**
6. Stress	1.10	.50					1	−.24**
Well-being								
7. Satisfaction	4.44	1.00						1

Note. *M* = Mean, *SD* = Standard Deviation, NR-Self = Nature Relatedness-Self, NR-Per = Nature Relatedness-Perspective, NR-Exp = Nature Relatedness-Experience.
**$p < .01$, *$p < .05$.

The CFA provided support for the initial measurement model (normed $\chi^2 = 1.85$, CFI = .91, RMSEA = .04, SRMR = .05). All indicators demonstrated significant factor loadings on their latent variables, βs = .31 to .72 at $p < .001$ (Table 2).

Table 2
Measurement Model

Construct	Items	Loadings	Composite reliability
Nature-Relatedness			
Nature-Relatedness-Self	NR 5	.52	
	NR 7	.63	
	NR 8	.46	
	NR 12	.60	.78
	NR14	.31	
	NR 16	.66	
	NR 17	.72	
	NR 21	.50	
Nature-Relatedness-Perspectives	NR 3	.32	
	NR11	.33	
	NR15	.33	.61
	NR18	.48	
	NR 19	.59	
	NR20	.52	
Nature-Relatedness-Experience	NR 1	.57	
	NR 4	.56	.63
	NR 6	.57	
Well-being			
Life Satisfaction	LS 1	.62	
	LS 2	.72	
	LS3	.56	.70
	LS 4	.50	
	LS 5	.40	
Mental Illness			
Stress	DASS 1	.34	
	DASS 6	.51	
	DASS 8	.54	
	DASS 11	.62	.76
	DASS 12	.70	
	DASS 14	.63	
	DASS 18	.54	
Anxiety	DASS 2	.35	
	DASS 4	.42	
	DASS 7	.46	
	DASS 9	.63	.75
	DASS 15	.67	
	DASS 19	.57	
	DASS 20	.67	
Depression	DASS 3	.35	
	DASS 5	.55	
	DASS 10	.68	
	DASS 13	.71	.78
	DASS 16	.62	
	DASS 17	.61	
	DASS 21	.54	

Note. All factor loadings presented are standardized and significant at $p < .001$. NR-Self = Nature Relatedness-Self, NR-Per = Nature Relatedness-Perspective, NR-Exp = Nature Relatedness-Experience, LS = Life Satisfaction, DASS = Depression, Anxiety, and Stress Scale.

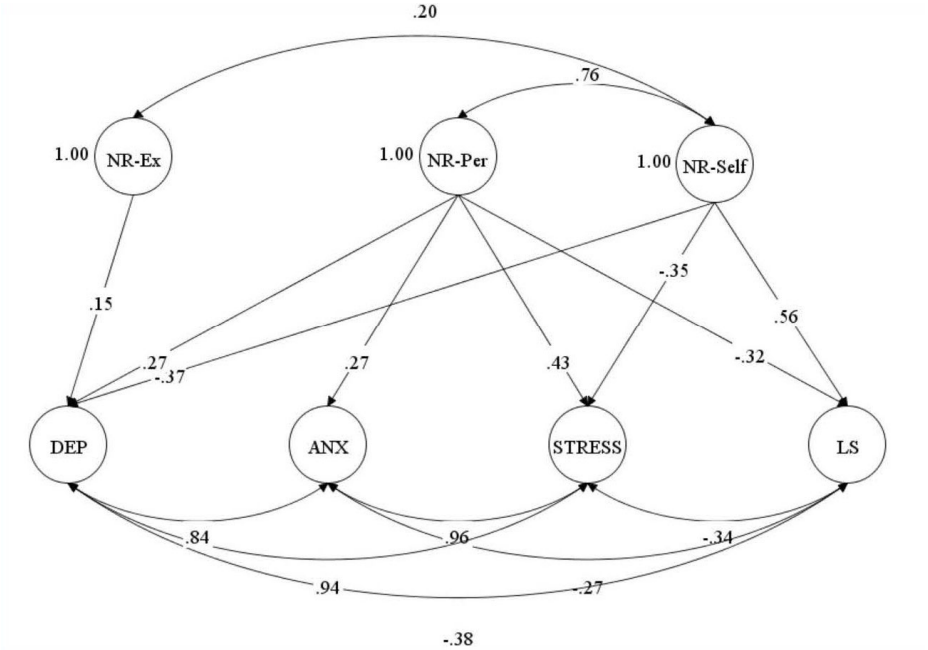
Besides, the Composite Reliability value for each construct ranges from .61 to .78, which is acceptable for exploratory research (Hair et al., 2014). All reliability and validity were assumed, and they also confirmed that all the measurement models were valid, suggesting that it was appropriate to test the structural model.

Main Analysis

We examined the structural model of the relationship between nature-relatedness and mental health. The model showed a good fit to the data (normed $\chi^2 = 1.23$, CFI = .97, RMSEA = .07, SRMR = .03). These results indicate that the relationships between nature-relatedness and the four indicators of mental health were statistically significant. The results of the path analysis are shown in Figure 1.

Figure 1

Structural Relations between Nature Relatedness and Mental Health



Note. NR-Self = Nature Relatedness-Self, NR-Per = Nature Relatedness-Perspective, NR-Ex = Nature Relatedness-Experience, LS = Life Satisfaction, DEP = Depression, ANX = Anxiety, STRESS = Stress. All path coefficients are standardized.

Cohen's (1988) guidelines were used to interpret effect sizes as small (β = .10), medium (β = .30), and large (β = .50). As expected, NR-Self significantly predicted greater life satisfaction (β = .56, 95% CI = [.47, .65], $p < .001$), lower stress (β = −.35, 95% CI = [−.47, −.23], $p < .01$), and lower depression (β = −.37, 95% CI = [−.49, −.25], $p < .001$). However, unexpectedly, NR-Perspective significantly predicted lower life satisfaction (β = −.32, 95% CI = [−.44, −.20], $p < .001$), higher levels of stress (β = .43, 95% CI = [.31, .55], $p < .001$), higher levels of anxiety (β = .27, 95% CI = [.14, .40], $p < .05$), and higher levels of depression (β = .27, 95% CI = [.15, .39], $p < .05$). In addition, NR-Experience significantly predicted depressive symptoms (β = .15, 95% CI = [.03, .27], $p < .05$).

DISCUSSION

In a global context, the prevalence of mental health problems among adolescents and young adults is on the rise (WHO, 2014). Nature-based interventions aimed at improving the mental health of young people are starting to gain popularity. However, more empirical evidence is needed to provide a solid foundation for policymaking in schools and communities, as there are still relatively few studies focusing on this age group, particularly in Southeast Asia. Besides, there is limited empirical data on the connection between nature-relatedness and mental ill-health in youth and young adult populations (Dean et al., 2018). Our present study, therefore, is conducted to confirm the potential role of nature-relatedness in promoting mental health in Vietnamese young adults by advocating for policymakers to consider more activities related to nature in the university's curriculum as well as extracurricular.

Firstly, the results of this research partly support the hypothesis put forward, that young adults having higher levels of NR-Self obtained higher levels of life satisfaction and lower levels of stress and depressive symptoms. These findings strengthen the conclusions from several previous studies (Capaldi et al., 2014; Nisbet et al., 2011) by proving that there is a significant and strong direct effect between NR-Self and life satisfaction. More importantly, as said, most previous studies have not proved the negative relationship between nature-relatedness and the negative aspects of mental health (e.g., stress, anxiety and depression), proposing that nature-relatedness may have a more important role in promoting well-being than buffering negative psychological health in university students. This finding, in contrast, highlights the potential role of

NR-Self as a protective factor against ill health; as in studies on adult samples (Hurly & Walker, 2019; Lawton et al., 2017). The relationship between NR-Self and better mental health may also be explained using the self-determination theory. Based on the self-determination theory, the fulfilment of basic human needs, such as the need for belonging can deliver satisfaction and is an important precondition for wellbeing (Ryan & Deci, 2017).

Unexpectedly, the path analysis reveals the cognitive aspect of nature-relatedness (NR-Perspectives) was moderately negatively related to life satisfaction and positively related to stress, anxiety and depression. In general, young adults with higher levels of NR-Perspective tended to experience lower levels of life satisfaction, and higher levels of stress, anxiety and depression. Besides, the experiential connection, which is an important aspect of nature-relatedness (Nisbet et al., 2009) had mild but significant association with depression. These findings seem inconsistent with widespread evidence of the well-being benefits of experiencing nature and a conservation worldview (Nisbet et al., 2011). Nevertheless, these findings appear to support those of Dean et al. (2018). The more young adults are aware of the adverse potential impacts of human behaviours on the environment, of the environmental problems and wide animal suffering, the higher levels of depression, stress and anxiety they experience. A study by Lawton et al. (2017) also revealed that experiencing nature could only predict lower somatic anxiety but not cognitive anxiety. The results from an experimental study by Kerr et al. (2006) even showed that the group walking in green space had higher stress levels than the group walking on machines in the gym. Several other studies have found a link between neuroticism and environmental concerns (Tam, 2013). These inconsistent results suggest that the correlations between nature-relatedness and mental health are very complex and need to be examined more carefully across national and regional student populations in future studies to draw solid and detailed conclusions before the widespread implementation of nature-based interventions for university students (Tam, 2013). Besides, further research needs to uncover the mechanisms behind the relationships between nature-relatedness and mental health, by proving mediating or moderating factors for the relationship between the two, so that these relationships may be more soundly explained (Capaldi et al., 2014).

However, it may come as little surprise that there is a potential link between high empathy with nature and anxiety and stress. When the environments we care about face difficulties, we experience that emotional pain right along with them. As long as it continues to struggle and we do not have the power to

improve, we might feel anxious and concerned on their behalf. Nevertheless, feeling empathetic is one thing, acting empathetically is another. If empathy can transform into action, the anxiety and stress may be alleviated, and life satisfaction may increase. We all feel good when we can alleviate others' suffering (Goetz et al., 2010). Accordingly, instead of being distressed from empathy, acting compassionately toward nature to relieve its sufferings such as reducing plastic bags, reducing air pollution, or planting trees… are more psychologically beneficial.

As an exploratory study in Vietnamese settings, our research provides detailed information to the current literature on the very complex relationship between nature-relatedness and mental health, which paved the way for future research in the field. Nevertheless, this study has some major limitations. First, the data obtained through the self-report method may affect the objectivity of the results. Future studies should include a variety of research methods such as structured interviews, focus group discussions and questionnaire surveys, with both quantitative and qualitative analysis. Second, the cross-sectional design is limited in its ability to draw valid conclusions as to the relationship between NR and mental health outcomes. Prospective longitudinal studies are required to carefully consider the causal pathways in this relationship. Third, it is essential to consider the impact of sampling bias in this study. The ratio of female to male participants exceeds four to one, and the sample is drawn exclusively from a public university in Central Vietnam. Therefore, the findings may not be representative of students at other institutions or of young adults with different demographic characteristics. To enhance the generalizability of future research, it would be advisable to incorporate a more diverse sample from various provinces across the country, ensuring balanced demographics.

In conclusion, the present study seems to affirm that among three aspects of nature relatedness, the affective aspect (NR-Self), in which the internalized identification with nature, the sense of feeling connected with nature, seeing nature as a part of their self-occur, is the strongest predictor of better mental health. Some authors place this aspect of nature-relatedness reflecting self-identification, at the centre of the human-nature relationship (Mayer & Frantz, 2004). In light of our findings, pro-environmental beliefs and enjoyment of and comfort in natural settings may not offer a promising way forward as potential well-being initiatives for university students. Instead, we propose that pro-environmental actions in favour of the environment are more expected.

CRediT Author Statement

CAT TUONG PHUOC NGUYEN (40%): conceptualization, methodology, writing (original draft), review and editing.

TUAN-VINH NGUYEN (30%): data curation, formal analysis, writing (original draft), review and editing.

MINH-THONG THAT TON (10%): software, data curation, visualization.

QUYNH-ANH NGOC NGUYEN (20%): investigation, validation, review and editing.

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