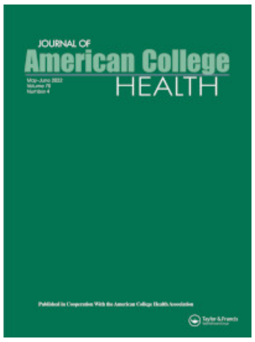

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Is nature relatedness associated with better mental health? An exploratory study on Vietnamese university students

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ABSTRACT
Objective: This study aims to examine the relationship between nature relatedness (NR) on subjective positive well-being (life satisfaction) and mental disorders (depression, stress, and anxiety) in Vietnamese university students. **Participants:** 340 Hue University students voluntarily took part in the survey. **Methods:** The Nature Relatedness Scale, Depression, Anxiety, and Stress Scale and Satisfaction with Life Scale were used. Bivariate correlation, single regression, and moderation analysis were conducted to investigate the relationship between NR and the mental health of university students and the moderating role of NR. **Results:** Higher levels of NR significantly predicted higher levels of life satisfaction but did not significantly predict fewer symptoms of depression, anxiety, and stress. NR significantly moderated the link between life satisfaction and depression, anxiety, and stress. **Conclusions:** The findings of this study imply that efforts to enhance students' mental health should include efforts to promote their NR.

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mental health; nature-relatedness; university students; Vietnamese

Introduction

Contrary to the common belief that "*Youth is the most beautiful stage of a human life*", today's young people "*have become and are becoming the unwilling, unintended victims of overwhelming stress - stress borne of rapid, bewildering social change and constantly rising expectation.*"[1] According to WHO statistics, mental health problems (e.g., depression, anxiety, stress, and suicide) have dramatically increased in adolescents and young adults in recent years, compared to older or younger individuals, and at an enormous cost.[2,3] For those who are participating in higher education institutions, although the years on campus can be a memorable phase of youth, an individual faces numerous pressures and challenges that pose a variety of physical, social, and emotional difficulties more than any other stage of education.[4] As a result, they become more vulnerable to mental health problems.[5,6] Studies on the prevalence of mental health issues have found that a significant number of students are experiencing mental illness worldwide[7,8] and that these disorders are increasing both in number and severity.[9] The most common disorders faced by students are stress, anxiety, depression, eating disorders, and other psychological problems, all of which negatively affect their mental health and academic performance.[10] However, young people aged 10–24 years have the bottom rate of health care coverage of any age group, and evidence suggests that the majority of adolescents and young adults with mental health conditions are undetected and untreated by experts.[11] Recently, a growing body of empirical evidence has shown that nature relatedness (NR) can play as a predictor of mental health of university students.

NR refers to "the affective, cognitive, and experiential relationship individuals have with the natural world or a subjective sense of connectedness with nature."[12(p.304)] The affective component of NR refers to an external, nature-related worldview reflecting the attitudes of recognizing and valuing the interconnectedness with other living things inhabiting the planet. The cognitive component of NR can be considered to be the extent to which people view nature as a part of themselves. The experiential component is the desire to be out in nature experiencing it directly.[13] More importantly, NR illustrates not only the tendency of an individual to engage in pro-environmental activities or to admire the beauty offered by nature but also their overall understanding and appreciation concerning the connectedness between humankind and all living creatures in nature, as well as of the importance of all aspects of nature, even those that are not appealing or useful to humans.[13] As understood by Bratman et al.,[14] complete mental health includes psychopathology or psychiatric disorders (negative mental health, e.g., depression, anxiety, and substance use disorders) and psychological well-being (positive mental health, e.g., positive emotions, life satisfaction, and feelings of accomplishment).

Literature has shown cross-culturally in the US, Canada, Russia, and Japan that NR is one of promising factors that can predict mental health among students, including life satisfaction or a sense of meaning and autonomy in life.[12,15,16] Some experimental studies also show that interventions that provide university students opportunities to experience nature directly, such as taking a walk along the tree-lined university campus or in a forest and cycling by the river,

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can effectively improve their mental health with a higher positive affect, a greater sense of purpose and autonomy in life, and more satisfaction with life.[12,17–23]

However, these studies cannot prove the protective role of NR on mental illness in university students. No significant prediction or effect of NR on lower depression, anxiety, and stress was found. On the other hand, some studies found that university students walking amidst nature experienced more stress than while walking on the machine in the gym center.[24] These seemingly incongruous findings and perspectives call for deeper consideration and further research.[15]

To better understand the relationship between NR and mental health, more studies need to be conducted with a range of population samples across different cultures and regions to permit a firm conclusion on this relationship before extending nature-based health intervention programs in universities on a large scale. Meanwhile, to the best of our knowledge, while a large portion of research concerning levels of subjective relationships with nature and mental health has been conducted using Western student samples (e.g., Canadian and American),[12,14,18] very little has been done on Eastern university students except for Japanese student samples.[2,21,22] Moreover, to our best knowledge, most research has focused on the direct predictive role of NR; the investigation of its indirect role on mental health through mediation and moderation analysis has not been conducted. In some studies, NR is found to be significantly positively related to life satisfaction of young people;[13,18] other studies show that life satisfaction is significantly negatively associated with depression and anxiety in university students.[25,26] Therefore, it can be assumed that NR may interact with life satisfaction in predicting mental illness. Such a potential moderating role of NR is worthy of consideration.

Vietnam has a high prevalence of young people with mental illness. According to a study by the United Nations Children's Fund,[27] it is estimated that there are at least 3 million young people and adolescents in Vietnam with mental health problems. The rate of depression in students is higher than in the general population, from 4–6%, increasing up to 16%. However, only about 20% of them receive the necessary medical support and treatment from professionals. In line with the general global context, in Vietnam, technological change, smartphone use, screen time, and, in particular, the burgeoning of indoor and virtual recreation options furthering the growing disconnection from nature increase the risk factors for mental health problems among young people.[2] The use of nature-based health interventions aiming to connect university students with nature can be a feasible approach to improve their mental health. However, more empirical evidence is needed to lay the foundation for such theoretically informed interventions. NR is a developing construct, which has not received much attention from researchers in Vietnam as yet at the time of this research. There has yet been no systematic research conducted to prove the role of NR levels in relation to mental health using a sample from Vietnamese university students. This present study therefore aims to (1) investigate the relationship between NR and mental health (e.g., depression, anxiety stress, and life satisfaction) and (2) examine the interaction between NR and life satisfaction in predicting mental illness in Vietnamese university students. With the theoretical background previously discussed, the researchers surmised that (1) NR would have a positive relationship with life satisfaction and a negative relationship with depression, anxiety, and stress and (2) NR would enhance the negative relationship between life satisfaction and mental illness.

Materials and methods

Participants and procedure

The participants in the present study are composed of 340 university students (63 men and 277 women) with a mean age = 19.7 ($SD = 1.39$; range = 19–28 years old) who belong to 3 universities of Hue University, Thua Thien Hue Province: the University of Education, the University of Foreign Languages, and the University of Economics. Ethical permission was obtained from the Department of Psychology and Education, University of Education, Hue University. All participants were informed about the purpose of the study in general terms but were not given any specific focus of the study which would lead to the investigator's objectives and were told that the survey would take a maximum of 30 minutes. Participation was voluntary, and the participants were assured confidentiality. The return of the completed questionnaire also means that they provided informed consent. Among the students, 214 completed the survey in person and 126 completed it online.

Measures

Nature relatedness

The 21-item Nature Relatedness Scale (NRS) was used to assess subjective connectedness with the natural environment in Vietnamese university students. The NRS consists of three subscales assessing the affective, cognitive, and experiential aspects of an individual's connection to nature of NR: (1) NR-Self including 8 items measuring personal connection to nature by reflecting the strength of self-identification of the individual with the natural environment (e.g., *My relationship to nature is an important part of who I am*); (2) NR-Perspective including 7 items measuring external worldviews of nature, reflecting the individual's personal connection with the environment, manifested in their attitude and behavior (e.g., *Animals, birds, and plants have fewer rights than humans*); (3) NR-Experience including 6 items measuring the individual's physical intimacy with, and interest in, nature (e.g., *My ideal vacation spot would be a remote, wilderness area*). Each subscale used a 5-point Likert scale ranging from 1 (disagree strongly) to 5 (agree strongly). Overall, NR score was calculated by averaging all 21 items (after reverse scoring appropriate items). Scores on the 3 NR dimensions were also calculated by averaging appropriate items after reverse scoring, whereby higher scores indicated a stronger connection with nature.

As a previous step before administering the questionnaires, the validation process of this scale was carried out. First, the forward translation was conducted with two independent researchers; one was knowledgeable about psychology and content area of the construct of the instrument in the desired target language, and the other was familiar with colloquial phrases, idiomatic expressions, and emotional terms in common use in the Vietnamese language. A comparison of the two translated versions was made. Any ambiguities and discrepancies among the versions was discussed and resolved with the advice of the experts to come up with a final unanimous version.[28]

In the next step, we analyzed the factor structure of the translated version by confirmatory factor analysis (CFA), using robust maximum likelihood estimation (MLR) given the non-normality of most item scores. First, a 3-factor model, as in the original version by Nisbet et al.,[13] was tested. Any item that did not fit the measurement model due to low factor loading (< .30) was removed from the model. The fitness of a measurement model is indicated through the following fit indices: normed chi-square (normed $\chi2$), comparative fit index (CFI), standardized root-mean-square residual (SRMR), and root mean square error of approximation (RMSEA). For a good model fit, normed $\chi2 < 2$, RMSEA < .05 (< .08 is acceptable), CFI > .95 (> .90 is acceptable), and SRMR < .05 (< .08 is acceptable).[29]

The results of the CFA analysis indicate that a 3-factor model fitted the data acceptably after removing 07 problematic items with factor loadings < .30 (i.e., Item 14 =.08; Item 2 =.15; Item 19 = .26; Item 20 = .17; Item 1 =.11; Item 6 = .24; Item 13 = .04) with normed $\chi2 = 1.25$, CFI = .96, RMSEA = .04, and SRMR = .05. Cronbach-alpha reliability coefficient of full NR scale was found to be .78; Cronbach-alpha reliability coefficient of NR-Self, NR-Perspective, and NR-Experience was found respectively to be .81, .61, and .62. The average inter-item correlation ranges from .15 to .50, and the average item-total correlation is over .35.[30] Nunnally and Bernstein[30] 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 helped demonstrate acceptable validity and internal consistency of the Vietnamese-translated version scale.

Mental health

To assess complete mental health of the participants, we used the Depression, Anxiety, and Stress Scale – 21 (DASS-21)[31] to assess the negative aspects and the Satisfaction with Life Scale (SWLS)[32] to measure the positive aspects of the mental health.

DASS-21[31] is a self-report instrument consisting of three 7-item subscales, designed to measure the emotional states of depression (e.g., *I felt that I had nothing to look forward to*), anxiety (e.g., *I was aware of dryness of my mouth*), and stress (e.g., *I found it difficult to relax*) over the last week, The responses are given on a 4-point Likert scale, ranging from zero if "I strongly disagree" to 3 if "I totally agree." Overall scores for the three constructs are calculated as the sum of scores for the relevant 7 items multiplied by 2. Ranges of scores correspond to levels of symptoms, ranging from "normal" to "extremely serious." In Vietnam, this instrument was translated and validated by Tran et al.[33] and was applied in many previous studies.[34,35] In this study, the Cronbach's alpha of depression, anxiety, and stress subscales were .89, .83, and .86, respectively, and of the full scale was .94.

SWLS[32] is a measure of the judgmental component of subjective well-being, accessing global life satisfaction of an individual. The participants indicated how much they agreed or disagreed with each of the 5 items (e.g., *If I could live my life over, I would change almost nothing*), using a 7-point scale (from 7 = strongly agree to 1 = strongly disagree). The validity and reliability of this scale were demonstrated in previous Vietnamese studies by Nguyen Phuoc et al.[36] and Nguyen Phuoc.[35] The Cronbach's alpha of the SWLS in this present study is .76.

Data analysis

Bivariate correlations were used to investigate quantitative data. Noticing that NR dimensions were highly correlated (r > 60), we tried to avoid the multicollinearity by using single linear regressions to examine the predictive role of NR on mental illness (depression, stress, and anxiety) and positive well-being (life satisfaction). Additionally, moderation analyses were carried out using the PROCESS macro for SPSS, developed by Hayes.[37] The procedures suggested by Hayes[38] allow for detecting an interaction effect on an outcome variable. All analyses were carried out with IBM SPSS Version 26.

Results

The relationships between nature relatedness and mental health

The means and standard deviations for the key variables are reported in Table 1. As the key variables were not multivariate normal, Spearman's correlation coefficients were used as an index of correlation among these variables. These correlations are also reported in Table 1. The descriptive statistics reveal that overall, university students showed above-average NR (3.7 ± 0.47; range: 1–5) scores. With a mean score of nearly 20, the life satisfaction levels of this sample represented a neutral point on the scale. The scores of depression and anxiety are borderline between the normal and mild ranges, and the scores of stress are within the normal range. The findings in Table 1 also show the significant negative correlation between life satisfaction and 3 dimensions of mental illness. More significantly, the findings reveal that overall, NR is significantly related to life satisfaction; NR-Self and NR-Perspective are also significantly related to life satisfaction, while NR-Experience is not associated with life satisfaction. Moreover, no significant correlations are identified between overall NR and its dimensions with overall mental illness and its dimensions.

Table 1. Descriptive statistics and intercorrelations among study variables.

	M	*SD*	1	1.1	1.2	1.3	2	2.1	2.2	2.3	3
1. Nature-relatedness	3.70	0.47	1								
1.1. NR-Self	3.80	0,62	.63**	1	1						
1.2. NR-Perspective	4.10	0.66	.49**	.90**	.25**	1					
1.3 NR-Experience	3.00	0.66	.31**	.56**							
2. Mental Illness	26.25	23.80	.04	-.06	-.06	-.06	1				
2.1. Depression	9.92	1.45	.03	-.04	-.07	-.07	.95**	1			
2.2. Anxiety	8.64	1.34	.07	.06	.07	.001	.62**	.51**	1		
2.3. Stress	7.67	1.94	.03	-.07	-.05	-.05	.91**	.80**	.60**	1	
3. Well-being – Life satisfaction	19.54	4.94	.12**	.19**	.19**	.07	-.21**	-.23**	-.43**	-.16**	1

Table 2. Standardized regression coefficients among nature relatednessand student mental health.

	Life Satisfaction	Depression	Anxiety	Stress
NR	.11**	.14	.02	.09
NR-Self	.18***	-.17	.07	-.10
NR-Perspectives	.18***	-.10	.09	-.008
NR-Experience	.06	.02	-.04	.007

***p < .001; **p < .01.

Next, as can be seen in Table 2, the standardized regression coefficients among NR and mental illness and life satisfaction also show that students with higher overall NR, NR-Self, and NR-Perspective are significantly predicted to be experiencing higher life satisfaction, while the predictability of NR on mental illness is not found. The R-squared values of the single regression models are .12, .10, and .08, respectively, indicating that the overall NR explains 12% of the variance life satisfaction (F (1, 338) = 4,632, $p < 0{,}05$), NR-Self explains 10% of the variance in life satisfaction ($F(1,\ 338) = 13.264$, $p < .001$), and NR-Perspective explains 9% of the variance in life satisfaction ($F(1,\ 338) = 12.488$, $p < .001$).

The moderating role of nature relatedness in the relationship between life satisfaction and mental illness

As seen in Table 3, 4 significant interactions were found, out of 12 interactions were tested. We used the simple slope plots by Dawson[39] to interpret interaction effects.

First, the interaction between life satisfaction and NR-Self is significant, suggesting that NR-Self affects the relation between life satisfaction and depression (Table 3). Figure 1a shows that adolescents with high life satisfaction but low NR-Self experience more stress. Similarly, the interaction between life satisfaction and NR-Perspective is significant, suggesting that the effect of life satisfaction on depression, anxiety, and stress also depends on the NR-Perspective level. As displayed in 1b, 1c, and 1d, the level of depression, anxiety, and stress would decrease in the effect of high NR-Perspective. Accordingly, adolescents who have both a high level of NR-Perspective and a higher level of satisfaction would experience the lowest levels of depression, anxiety, and stress.

Discussion

Promoting the mental health of university students is believed to be necessary. A nature-based approach is assumed to help enhance the mental health of young people. The results of this present study show that in general, the level of NR, especially the 2 dimensions of NR-Self and NR Perspective, is correlated only with the positive side of mental health, i.e., life satisfaction, but not statistically significantly related with the negative side of mental health, i.e., stress, anxiety, and depression, revealing that the predictive role of NR might be more crucial in increased happiness than decreased negative psychological well-being. These findings are consistent with previous cross-sectional, longitudinal, and experimental studies on university students.[12,15] Research results on adult samples also show evidence of inconsistency in the relationship between NR and negative emotions. Some studies show that there is a negative correlation between NR and anxiety and depression.[12,40] In contrast, other studies did not find a statistically significant relationship between NR and mental disorders.[41,42] These authors also argued that the promotion of positive states may be the primary emotional benefit of NR and that the buffering of negative states may be secondary and less pertinent. However, positioning the buffering states as a lesser benefit of NR may be against some of the most common reasons people give for why they seek contact with nature.[15] According to Capaldi et al.,[15] the relatively low average level and a small amount of variability in overall scores and dimensional scores of mental illness or negative effects might have restricted the ability to detect an association between these variables. This interpretation may also be applied to our data in this current study. Moreover, indeed, there is a need for deeper consideration and further research in which potential mediators and moderators are investigated and meta-analysis and systematic analysis conducted on existing research.[15]

One aspect that might be problematic and unpersuasive in the findings is that the R-squared and beta is not as high as expected and the bet the weakness of the emerging relationships between NR and life satisfaction. However, this index is still different from 0 and shows that the regression model has predictive power. The low R-squared value indicates that the dependent variable can be influenced by many other factors apart from the factor analyzed in this study. Thus, it can be seen that there are several factors affecting university students' life satisfaction, such as social support, self-esteem, and economic conditions of the family. NR could be one such factor worth noting. For studies in the social field where complex social phenomena are studied, low R-squared values are relatively common, even R-squared = .09 (i.e., predicting the variation of the dependent variable above

Table 3. Mental illness predicted from life satisfaction and nature relatedness in students.

Predictors	*B*	*SE B*	*t*	*p*
LS – NR – Depression				
Constant	0,54 [0,46; 0,69]	0,05	39,88	<0,001
LS (centered)	0,80 [0,61; 1,10]	0,10	8,12	<0,001
NR (centered)	0,13 [-0,01; 0,27]	0,07	1,79	0,07
LS x NR	0,01 [-0,22; 0,24]	0,12	−1,16	0,92
LS – NR - Anxiety				
Constant	0,74 [0,53; 0,79]	0,05	49,28	<0,001
LS (centered)	−0,31 [-0,44;- 0,17]	0,07	−4,54	<0,001
NR (centered)	0,18 [-0,01; 0,27]	0,08	2,41	<0.05
LS x NR	−0,07 [-0,24; 0,11]	0,09	−0,72	0,47
LS – NR - Stress				
Constant	0,67 [0,58; 0,73]	0,05	49,28	<0,001
LS (centered)	−0,25 [-0,41;- 0,08]	0,08	−3,00	<0,05
NR (centered)	0,17 [0,01; 0,33]	0,08	2,21	<0.05
LS x NR	0,02 [-0,20; 0,26]	0,11	0,23	0,81
LS – NR-Self- Depression				
Constant	0,64 [0,57; 0,70]	0,03	18,83	<0,001
LS (centered)	−0,14 [-.20; 0,06]	0,03	−3,95	<0,001
NR-Self (centered)	−0,11 [0,25; 0,04]	0,07	−1,42	0,16
LS x NR-Self	**-0,20 [-0,34; −0,06]**	**0,07**	**−2,10**	**<0,05**
LS – NR Self – Anxiety				
Constant	0,39 [0,38; 0,53]	0,04	25,12	<0,001
LS (centered)	−0,28 [-0,68; −0,24]	0,03	−3,95	<0,001
NR-Self (centered)	−0,29 [-0,61; −0,17]	0,11	3,53	<0,001
LS x NR-Self	−0,07 [-0,39; 0,24]	0,16	−0,47	0,63
LS – NR Self- Stress				
Constant	0,39 [0,38; 0,42]	0,05	29,12	<0,001
LS (centered)	−0,23 [-0,39;- 0,07]	0,08	−2,91	<0,01
NR-Self (centered)	0,41 [0,19; 0,63]	0,11	3,68	<0,01
LS x NR-Self	−0,29 [-0,59; 0,02]	0,16	−1,82	0,06
LS – NR-Perspective- Depression				
Constant	0,63 [0,57; 0,70]	0,03	18,84	<0,001
LS (centered)	−0,13 [-0,19; −0,06]	0,03	−3,79	<0,001
NR-Perspective (centered)	−0,09 [-0,20; 0,02]	0,06	−1,58	0,11
LS x NR-Perspective	**-0,15 [-0,24; −0,05]**	**0,05**	**-3,00**	**<0,01**
LS – NR-Perspective- Anxiety				
Constant	0,56 [0,50; 0,61]	0,03	19,06	<0,001
LS (centered)	−0,09 [-0,19; −0,03]	0,03	−3,11	<0,01
NR-Perspective (centered)	−0,09 [-0,18; 0,01]	0,05	−1,79	0,07
LS x NR-Perspective	**-0,10 [-0,18; −0,05]**	**0,04**	**-3,09**	**<0,01**
LS – NR-Perspective- Stress				
Constant	0,72 [0,65; 0,79]	0,04	20,82	<0,001
LS (centered)	−0,10 [-0.17; −0,02]	0,07	−2,81	<0,001
NR-Perspective (centered)	−0,06 [0,17; 0,06]	0,08	−0,94	0,35
LS x NR-Perspective	**-0,11 [-0,21; −0,10]**	**0,05**	**-2,16**	**<0,05**
LS – NR-Experience- Depression				
Constant	0,52 [0,45; 0,59]	0,05	30,62	<0,001
LS (centered)	−0,24 [-0.41; −0,08]	0,08	−2,94	<0,001
NR-Experience (centered)	−0,09 [-0,06; 0,26]	0,08	−0,94	0,24
LS x NR-Experience	−0,08 [-0,31; 0,14]	0,11	−0,71	0,47
LS – NR-Experience- Anxiety				
Constant	0,42 [0,35; 0,49]	0,05	44,62	<0,001
LS (centered)	−0,30 [-0,44; −0,17]	0,07	−4,43	<0,001
NR-Experience (centered)	−0,09 [-0,07; 0,25]	0,08	1,10	0,27
LS x NR-Experience	−0,12 [-0,31; 0,14]	0,10	−1,16	0,24
LS – NR-Experience- Stress				
Constant	0,62 [0,49; 0,69]	0,05	32,61	<0,001
LS (centered)	0,82 [0,62; 1,02]	0,10	8,27	<0,001
NR-Experience (centered)	−0,09 [-0,05; 0,24]	0,08	1,21	0,22
LS x NR-Experience	−0,05 [-0,22; 0,32]	0,10	0,36	0,71

the independent variable by only 9%).[43] Even if the predictive power is low, it is nevertheless meaningful and reliable and still worth considering.[43] Therefore, positive perspectives about living beings and the environment around them, such as believing that all living beings have equal rights similar to humans, respecting natural conservation and protection, identifying the self as part of the Web of life, and seeing the presence of nature in oneself, can be linked to the enhancement of life satisfaction of university students.

In another aspect, given the weak correlations between NR and life satisfaction, as well as the finding novelty with a Vietnamese sample, it is imporrtant to replicate this study. Very recently, in an experimental study investigating the effect of NR on the mental health of Hue University students, with the aim at validating the NR scale[12] for use in pre and post-testing, Ton et al.[44] replicated the findings involving NR and life satisfaction on a larger sample of respondents ($n = 534$ Hue University students). Applying the SEM approach with path analysis, they found stronger

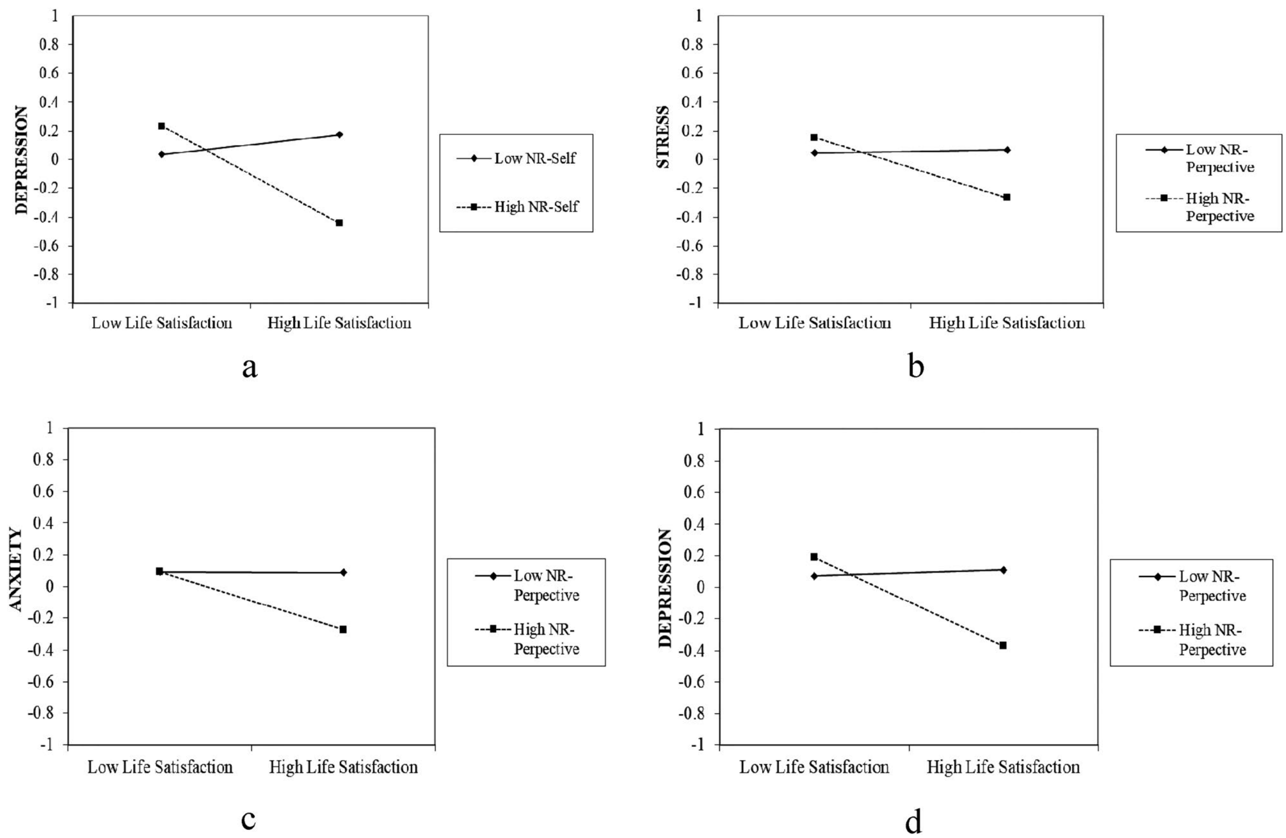

Figure 1. Interactions between life satisfaction and nature relatedness in the prediction of mental illness.

positive correlations between NR, NR-Self and NR Perspective and life satisfaction ($b = .37$, .46 and 35 respectively).

Though not indirectly predicting mental illness of university students, as shown in the findings, NR interacts with life satisfaction in predicting mental illness. NR enhances the negative relationship between life satisfaction and depression, anxiety, and stress. Particularly, life satisfaction negatively predicted depression, anxiety, and stress in university students with either low or high levels of NR-Self and NR-Perspective; however, this relationship was stronger among those high in NR-Self and NR-Perspective. Thus, although life satisfaction is more powerful in predicting distress symptoms, NR-Self and NR-Perspective were found to play an important role in enhancing the positive effect of life satisfaction in Vietnamese university students. Rather than predicting depression, anxiety, and stress directly, NR may be indirectly linked to reduced distress by strengthening the level of life satisfaction.

Given its exploratory nature, this preliminary study is subject to at least 4 fundamental limitations that need to be overcome in future studies. First, the data obtained through self-report measures suffer social desirability and response bias which may affect the results. Future research should include mixed research methods (e.g., questionnaires and structured interviews) and mixed analysis to reduce the impact of these biases. Second, limited by using a cross-sectional design, this study is a one-time snapshot of student experiences. Accordingly, the information produced from this study is descriptive and correlational, and the causal directions cannot be supported. An experimental or longitudinal replication study to confirm the results of this study would be a promising area for future research. Third, due to the online data collection, the accuracy in terms of answering the items in the questionnaire may not be high enough. We had to remove up to 07 items in the original questionnaire to ensure the validity and reliability of the scale. In addition to the direct and on-site collection of questionnaires to provide timely instructions and explanations to participants, ensuring that they correctly understand the instructions and meaning of each item, the backward translation process as well as the establishment of a correctional expert committee, as suggested by Sousa and Rojjanasrirat[45], need to be carried out in future studies. Fourth, the sample for this study was drawn from a population of students in 3 public universities in only 1 province of Vietnam. Thus, the results may not be generalizable to students at other institutions in other regions or with other demographics. The generalizability of the findings of the future study could be enhanced further by covering more samples from different provinces of the country.

Despite the abovementioned limitations, the researchers are convinced that this research makes a theoretical contribution concerning the relationship of NR and mental health, which to date have not been studied in Vietnam, which may pave the way for further studies in the field. The results of this study may raise the awareness of educational policymakers in the importance of NR so that they become more focused on nature-based strategies, such as integrating experiential activities with nature in academic modules (e.g., Biology, Literature, Physical Education, and Psychology), organizing practical extracurricular activities for students (e.g., planting more trees), launching campaigns of cleaning up the environment, promoting the use of natural materials, reducing the use of plastic bags, and prioritizing the use of recycled products so that students can connect to nature in a more meaningful way through increased positive attitudes and behaviors toward environmental conservation. Students themselves need to spend more time outdoors and actively participate in environmental protection projects at school and in the locality to raise positive attitudes and experiences with the natural environment.

Conflict of interest disclosure

The authors have no conflicts of interest to report. The authors confirm that the research presented in this article met the ethical guidelines, including adherence to the legal requirements, of Vietnam and received approval from the Institutional Review Board of University of Education, Hue University.

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