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ORIGINAL PAPER

Development of the Nonattachment Scale-Short Form (NAS-SF) Using Item Response Theory

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Abstract
Research on nonattachment has consistently shown that it is conducive to psychological well-being and interpersonal outcomes. However, there is a lack of rapid assessment that can provide valid and reliable measure among individuals with different levels of nonattachment. The present study aimed at developing a short form of the Nonattachment Scale (NAS) under the item response theory framework. Study 1 recruited 1019 participants who were mainly students and they completed the Nonattachment Scale. Based on the item information and item location, eight items were selected that yielded satisfactory internal consistency and test information. In study 2, 393 college students were recruited and the criterion validity of the 8-item Nonattachment Scale - Short Form (NAS-SF) was examined. Results showed that the 8-item NAS-SF was correlated with mindfulness ($r = .54$), mental well-being measures ($rs = .46$ to $.54$), psychological distress measures ($rs = -.48$ to $-.57$), and social/interpersonal measures ($rs = .24$ to $.41$). Findings suggested that the 8-item NAS-SF is a reliable and valid measure that can be applied to individuals with different levels of nonattachment in an efficient way.

Keywords Nonattachment · Item response theory · Short form · Validation

According to the teachings of Buddhism, anything, including the self, others, or the world, is ever-changing and impermanent (Ñanamol and Bodhi 1995). Based on this notion, phenomenon arises as a result of different conditions and causes. In other words, everything can change at any moment depending on the interaction of the conditions and causes around it. When nothing can exist as a static, independent, and permanent entity, the desire to hold on to experiences, objects, or images with the illusion and belief that they will not change is bound to cause suffering (Mclntosh 1997). In contrast, when individuals understand the ever-changing and impermanent nature, one may be free from fixating or clinging onto any objects or mental images. This release from mental fixations is called nonattachment, which is also defined as "a flexible, balanced way of relating to one's experiences without clinging to or suppressing them" (Sahdra et al. 2015, p. 2). When individuals are able to "let go" of the mental fixations, their well-being will be independent from the attainment of specific conditions, images, people, or anything, which they do not have complete control over.

As further explained by Sahdra et al. (2010), the insight of the ever-changing nature of reality, and therefore the release of mental fixation, can occur through mindfulness practice. Mindfulness can be defined as a moment-to-moment intentional awareness of the present moment with curiosity and openness (Kabat-Zinn 1990; Bishop et al. 2004). The practice of mindfulness with the intentional awareness of the present moment may help to gain insight onto the ever-changing nature of reality and promote nonattachment among practitioners. It has been suggested that nonattachment is one of the processes through which mindfulness exerts its beneficial effects (Brown et al. 2007). Consistent with this view, one study showed that nonattachment was one of the strongest correlates with mindfulness experience and it was also one of the mechanisms through which it reduced depression among a group of meditators (Tran et al. 2014). Other studies also showed that nonattachment mediated the relationship between mindfulness and well-being (Ju and Lee 2015; Sahdra et al. 2016). As

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concluded by Sahdra et al. (2016), "it (nonattachment) may be one of the outcomes of long-term mindfulness practice, and a mechanism through which mindfulness promotes effective pursuit of valued goals and satisfaction with life" (p. 827). They also found that after controlling for the effect of mindfulness, nonattachment showed an additional 7 and 10% variance in predicting satisfaction with life and life effectiveness, respectively, further providing support to the incremental validity of nonattachment with mindfulness.

Sahdra et al. (2010) also argued that nonattachment is different from being aloof, uncaring, or unengaged, and they supported the idea by demonstrating that nonattachment was inversely associated with anxious and avoidant attachment, depersonalization, difficulties identifying and describing feelings, and dissociation from one's thoughts and feelings and positively associated with empathic concern. Nonattachment is thought to be conducive to a number of socially and psychologically adaptive outcomes and is asserted to be a potentially important psychological quality (Sahdra et al. 2010). However, it is only until recently that the concept of nonattachment has been empirically tested in the realm of psychological research.

To develop an instrument that can be used to study nonattachment based on the teachings in Buddhism, Sahdra et al. (2010) defined the construct according to classical and contemporary Buddhist writings and scholars. They first developed a 72-item preliminary nonattachment scale (NAS) and tested the items among college students at a university in California and among a sample of US adults. Results suggested that the final 30 items, including 3 reversed-coded items, accounted for 35.24% item variance with excellent internal consistency (Cronbach's alpha = .94). By testing the 30 items among another US adult sample, results further validated the scale and confirmatory factor analysis (CFA) showed a good fit to the single-factor model. The scale also demonstrated satisfactory test-retest reliability and construct validity, with moderate to strong positive correlation with mindfulness, acceptance, nonreactivity, and noncontingent happiness. These results demonstrated that nonattachment can be an indicator of adaptive psychological functioning.

With the satisfactory reliability and validity demonstrated in the original validation, the NAS was further validated in Chinese (Zhao and Chen 2013) and Spanish (Feliu-Soler et al. 2016) samples. Consistent with the original validation results, the NAS was shown to be unidimensional based on exploratory factor analysis (EFA) and had satisfactory validity in both the Taiwanese and Spanish samples. It was shown that nonattachment was negatively associated with stress and anxiety and positively associated with resilience, further demonstrating its protective role against mental afflictions (Feliu-Soler et al. 2016). In addition, the authors in the study also compared the level of nonattachment among meditators, nonmeditators, and people diagnosed with borderline personality disorder to examine the known-group validity of the NAS. Results showed moderate-to-strong effect sizes on the differences of nonattachment between the three groups, with meditators having highest level of nonattachment, followed by nonmeditators and then people diagnosed with borderline personality disorder. Among the meditators, meditation practice time was positively associated with nonattachment and these results were consistent with the findings from Sahdra et al. (2010), who also found a similar pattern in the relationship between meditation practice and nonattachment. These findings supported the sensitivity of the 30-item NAS in discriminating between the groups that were hypothesized to have varied levels of nonattachment.

The aforementioned studies have supported the validity of the NAS in measuring nonattachment, as well as its use across several languages and cultures. Research on nonattachment starts burgeoning by applying the NAS in different settings and its psychological and interpersonal benefits have consistently been shown (e.g., Ju and Lee 2015; Lamis and Dvorak 2014; Sahdra et al. 2010, 2015). Nonattachment was found to have moderate to strong positive correlations with life satisfaction and positive affect, as well as moderate to strong negative correlations with negative affect and psychological distress (Wang et al. 2016). However, to examine the role of nonattachment in settings where time is limited and long batteries of instruments are not allowed, a short version of the scale will be useful. One study has employed a 7-item NAS derived from the original NAS and applied it among adolescents (Sahdra et al. 2015). A satisfactory fit and reliability was found in their study. However, in another study, the model fit for both the full scale and the 7-item short form was not satisfactory (Feliu-Soler et al. 2016). While EFA showed a one-factor solution of the 30-item NAS, CFA did not show satisfactory model fit for the full scale. They found that the model fit for the 7-item NAS was better than the full scale, but the fit indices were still inadequate. In addition, their analyses assumed that the NAS items were continuous, which might produce biased results (e.g., Finney and DiStefano 2013). Although the authors concluded that the NAS-7 could be a better option than the full scale especially in busy settings, they noted that they did not provide independent administration of the abridged scale in testing the model fit.

In view of the importance to establish an efficient, valid, and reliable scale to reflect the relatively new construct, the main aim of the present study was to develop an abridged version of the NAS by examining the psychometric properties of the NAS using item response theory (IRT; Embretson and Reise 2000). Unlike classical test approaches, IRT provides detailed information at the item level and takes into account the relationship between individuals' ability level on the latent trait and his/her responses to the item. Instead of providing only a single overall reliability estimate for the whole test in classical test approaches, IRT provides item information, or measurement precision, for different ability levels. Past studies did not employ IRT in analyzing the psychometric

properties of the scale for the development of a short form scale. Reduction of items from a full lengthy scale to relieve the burden of respondents from completing long batteries of instruments is needed, but such shortening of items should not be done at the expense of significant loss of measurement precision. By applying the item response theory in the development of the NAS-Short Form (NAS-SF), sets of items can be selected that give adequate measurement precision and information across the entire range of the latent trait (i.e., the entire continuum of nonattachment level in the present study). To achieve the aim of developing the NAS-SF, two studies were conducted. Study 1 focused on shortening the NAS by means of the IRT approach; Study 2 examined the criterion validity and the psychometric properties of the NAS-SF in another sample.

Study 1

Method

Participants

The sample for study 1 consisted of 1019 participants (mean age = 22.17, SD = 6.14, 72.23% female). A majority of the participants were students ($N = 876$; 86.0%) and 113 (11.1%) of them were staff. The remaining 30 (2.9%) participants did not indicate their occupation. Among the students, 637 (72.7%) were undergraduate students, 70 (8%) were postgraduate students, and the remaining 169 (19.3%) participants did not indicate their education level.

Procedures

Participants were recruited by sending mass mail to students and staff at The Chinese University of Hong Kong. Upon informed consent, participants were given a self-administered questionnaire that included the NAS. The study was approved by the university's survey and behavioral research ethics committee.

Measures

Nonattachment The 30-item Nonattachment Scale (NAS) was used to measure nonattachment (Sahdra et al. 2010). The scale has been translated into Chinese and back-translated into English. Discrepancies between the original English version and the back-translated version were discussed and modified by the team. Participants rated the items from 1 (*disagree strongly*) to 6 (*agree strongly*). Three items were reversed-coded and higher scores indicate higher level of nonattachment. Excellent internal consistency (Cronbach's alpha = .93) was demonstrated in the present sample.

Data Analyses

For the 30-item NAS, unidimensionality was first assessed using eigenvalues and exploratory factor analyses on the polychoric correlation matrix with maximum likelihood using the psych package (Revelle 2017) in R. The graded response model (GRM; Samejima 1969, 1997) was then fitted to the items using the R package mirt (Chalmers 2012), and the overall model fit was evaluated using the M_2^* statistic (Cai and Hansen 2013) and the corresponding RMSEA reported in the mirt package. A statistically significant M_2^* indicates rejection of exact fit of the model to the data; however, given large sample size, trivial misfit can be rejected by M_2*, and following previous research, we considered a model has adequate fit with RMSEA < .08 (Hu and Bentler 1999; Edwards et al. 2015). We also assessed the degree of local dependence among items by inspecting the fitted residuals, with residual correlations > .20 in absolute values indicating potential local dependence problems (Revicki et al. 2015). If the model did not fit, we relaxed the local independence assumption for pairs of items that gave the largest residual values by specifying a bifactor graded response model (as a model of multidimensional IRT), with a general factor for all items and a specific factor uncorrelated with the general factor for each pair of items showing substantial local dependence.

Before item selection, we also evaluated for differential item functioning for the NAS items with respect to gender (280 males, 736 females, 3 missing) and age groups based on normative age cutoff for bachelor's degree education (22 or below vs. 23 or above). Following Millsap (2011), likelihood ratio tests were conducted to compare models with and without the discrimination parameters being equal across groups and then for models with and without all threshold parameters being equal across groups.

Item selection was then selected based on an item's contribution to the test information across a range of trait levels (denoted as θ), so that the short version of the NAS can be used for a population broader than our current sample. Specifically, we selected items that maximized the information in the range of [− 3, 3] for normality distributed θ (i.e., from 3 SD below the sample mean to 3 SD above the sample mean), while also covering a good range of locations (i.e., the peaked region of their item information curve).

Results

Unidimensionality and Model Fit

The first seven eigenvalues for the polychoric correlation matrix of the 30 items of the NAS were 11.71, 1.70, 1.41, 1.30,

1.11, 1.03, and 0.97. As expected, the items showed strong unidimensionality with the ratio of the first eigenvalue to the second eigenvalue matrix being 6.88 to 1, but the variance explained by the first factor was 37%, giving evidence that the single factor did not fully capture all associations among the items. Fitting a unidimensional GRM to the data gave $M_2^* = 2012$, $df = 285$, $p < .001$, RMSEA = .0787, 90% CI [.074, .080], and standardized root mean square residual (SRMSR) = .068, indicating some misfit of the unidimensional GRM. Evaluations of the residuals revealed that residual correlations for items 25 and 30, items 19 and 20, and items 4 and 15 were higher than .20, and relaxing the local independence assumption for these pairs of items resulted in an improved model fit with $M_2^* = 1466$, $df = 282$, $p < .001$, RMSEA = .064, 90% CI [.061, .067], and SRMSR = .055, and all residual correlations had absolute values < .20. We also investigated item fit using $S\text{-}\chi^2$ (Orlando and Thissen 2000, 2003), and we found no statistically significant evidence for item misfit (with all $ps > .024$, which were not statistically significant after accounting for multiple testing). Therefore, we based our item selection decisions on the parameter estimates of the modified GRM, and the parameter estimates were shown in Table 1.

Based on the modified GRM, we then conducted likelihood ratio tests to investigate differential item functioning (DIF). The fit for the unconstrained multiple-group model was good, with $M_2^* = 1935$, $df = 564$, $p < .001$, and RMSEA = .049. Adding equality constraints to the item discriminations did not result in worse fit, with changes in −2 log-likelihood (LL) = 30.48, $df = 29$, $p = 0.39$, $M_2^* = 1998$, $df = 593$, $p < .001$, and RMSEA = .048. Adding equality constraints to all threshold parameters gave changes in −2LL = 213.8, $df = 149$, and $p < 0.001$. However, the model with all threshold and discrimination parameters set equal across the

Table 1 Item discrimination (a), category threshold (b_i), and confidence interval (CI) for each item of the 30-item NAS

Item	a	a CI	b_1	b_1 CI	b_2	b_2 CI	b_3	b_3 CI	b_4	b_4 CI	b_5	b_5 CI
1	1.27	[1.13, 1.40]	−3.05	[−3.22, −2.85]	−1.47	[−1.47, −1.47]	−0.63	[−0.67, −0.58]	0.38	[0.24, 0.54]	2.07	[1.67, 2.56]
2	1.16	[1.02, 1.29]	−2.88	[−2.91, −2.84]	−1.24	[−1.24, −1.24]	−0.47	[−0.53, −0.41]	0.55	[0.39, 0.75]	2.43	[1.92, 3.07]
3	1.14	[1.00, 1.27]	−2.81	[−2.84, −2.76]	−1.37	[−1.36, −1.38]	−0.40	[−0.45, −0.33]	0.71	[0.53, 0.95]	2.61	[2.07, 3.31]
4	0.43	[0.33, 0.53]	−6.56	[−5.94, −7.56]	−3.25	[−2.95, −3.73]	−0.38	[−0.54, −0.12]	2.07	[1.41, 3.12]	5.64	[4.09, 8.12]
5	1.50	[1.34, 1.66]	−3.06	[−3.27, −2.80]	−1.62	[−1.61, −1.63]	−0.69	[−0.72, −0.65]	0.44	[0.31, 0.60]	1.95	[1.57, 2.43]
6	0.92	[0.80, 1.04]	−3.83	[−3.92, −3.71]	−2.39	[−2.33, −2.47]	−1.13	[−1.12, −1.14]	0.37	[0.22, 0.57]	2.08	[1.65, 2.65]
7	1.09	[0.97, 1.22]	−3.64	[−3.88, −3.33]	−1.93	[−1.89, −1.98]	−0.77	[−0.80, −0.74]	0.50	[0.35, 0.70]	2.04	[1.64, 2.53]
8	0.73	[0.63, 0.82]	−3.93	[−3.99, −3.86]	−1.78	[−1.74, −1.83]	−0.40	[−0.47, −0.30]	0.87	[0.64, 1.17]	2.88	[2.27, 3.67]
9	0.51	[0.42, 0.60]	−4.60	[−4.45, −4.82]	−2.11	[−2.00, −2.25]	−0.60	[−0.67, −0.50]	0.73	[0.46, 1.12]	2.83	[2.15, 3.80]
10	0.65	[0.55, 0.75]	−4.49	[−4.47, −4.53]	−2.08	[−2.00, −2.18]	−0.55	[−0.61, −0.45]	0.75	[0.51, 1.09]	3.15	[2.43, 4.14]
11	1.02	[0.90, 1.14]	−3.78	[−3.89, −3.63]	−1.93	[−1.91, −1.96]	−0.84	[−0.87, −0.81]	0.48	[0.31, 0.68]	2.12	[1.68, 2.68]
12	0.82	[0.71, 0.92]	−4.08	[−4.23, −3.88]	−2.48	[−2.43, −2.55]	−1.34	[−1.33, −1.36]	0.04	[−0.08, 0.19]	2.08	[1.65, 2.65]
13	0.33	[0.25, 0.41]	−5.03	[−4.48, −5.94]	−0.50	[−0.61, −0.30]	3.59	[2.56, 5.27]	6.06	[4.27, 9.01]	8.84	[5.73, 13.96]
14	0.85	[0.73, 0.96]	−3.88	[−3.93, −3.82]	−2.11	[−2.05, −2.20]	−0.58	[−0.63, −0.52]	0.80	[0.58, 1.09]	2.87	[2.23, 3.71]
15	1.02	[0.88, 1.16]	−3.86	[−3.85, −3.87]	−2.14	[−2.08, −2.21]	−0.65	[−0.70, −0.58]	1.00	[0.74, 1.34]	2.95	[2.33, 3.78]
16	0.97	[0.86, 1.08]	−2.76	[−2.73, −2.79]	−1.38	[−1.37, −1.39]	−0.30	[−0.37, −0.21]	0.95	[0.72, 1.23]	2.87	[2.28, 3.62]
17	1.24	[1.11, 1.37]	−3.30	[−3.41, −3.18]	−2.04	[−2.02, −2.06]	−0.89	[−0.91, −0.86]	0.42	[0.28, 0.60]	2.24	[1.79, 2.80]
18	1.29	[1.14, 1.45]	−3.28	[−3.43, −3.09]	−2.03	[−2.02, −2.05]	−1.08	[−1.09, −1.08]	0.28	[0.16, 0.44]	1.84	[1.46, 2.31]
19	1.17	[1.02, 1.33]	−3.28	[−3.22, −3.37]	−1.75	[−1.71, −1.79]	−0.65	[−0.69, −0.59]	0.55	[0.36, 0.80]	2.18	[1.73, 2.76]
20	1.30	[1.14, 1.46]	−3.55	[−3.55, −3.55]	−2.07	[−2.02, −2.15]	−1.02	[−1.03, −1.01]	0.17	[0.04, 0.33]	1.91	[1.53, 2.40]
21	1.60	[1.44, 1.77]	−3.25	[−3.44, −3.01]	−1.65	[−1.66, −1.64]	−0.67	[−0.7, −0.63]	0.54	[0.40, 0.71]	2.06	[1.64, 2.57]
22	1.05	[0.93, 1.17]	−4.03	[−4.46, −3.49]	−2.17	[−2.15, −2.19]	−0.95	[−0.97, −0.93]	0.31	[0.18, 0.48]	2.19	[1.76, 2.73]
23	1.17	[1.03, 1.30]	−3.36	[−3.45, −3.24]	−2.27	[−2.25, −2.28]	−1.03	[−1.04, −1.02]	0.29	[0.16, 0.45]	2.15	[1.73, 2.68]
24	0.46	[0.37, 0.55]	−5.18	[−4.90, −5.61]	−3.07	[−2.83, −3.42]	−1.33	[−1.29, −1.38]	−0.17	[−0.31, 0.03]	1.89	[1.38, 2.66]
25	0.66	[0.53, 0.78]	−3.52	[−3.28, −3.88]	−0.82	[−0.88, −0.73]	1.25	[0.85, 1.84]	3.09	[2.32, 4.20]	5.51	[4.13, 7.53]
26	0.41	[0.32, 0.50]	−5.26	[−4.85, −5.88]	−2.93	[−2.68, −3.31]	−1.04	[−1.05, −1.03]	1.01	[0.64, 1.58]	3.84	[2.82, 5.41]
27	0.88	[0.78, 0.99]	−3.44	[−3.46, −3.40]	−1.83	[−1.79, −1.87]	−0.55	[−0.60, −0.48]	0.76	[0.56, 1.02]	2.62	[2.06, 3.33]
28	0.83	[0.72, 0.95]	−3.61	[−3.60, −3.62]	−1.85	[−1.81, −1.91]	−0.55	[−0.60, −0.48]	0.96	[0.70, 1.29]	3.01	[2.33, 3.91]
29	1.13	[1.00, 1.26]	−3.53	[−3.59, −3.44]	−2.01	[−1.98, −2.03]	−0.89	[−0.91, −0.87]	0.47	[0.32, 0.65]	2.31	[1.86, 2.88]
30	0.65	[0.52, 0.79]	−3.45	[−3.18, −3.87]	−0.65	[−0.73, −0.53]	1.83	[1.30, 2.63]	3.86	[2.89, 5.33]	6.56	[4.72, 9.34]

two genders still showed good fit ($M_2^* = 2394$, $df = 742$, $p < .001$, RMSEA = .047), and when we considered each item separately, none of the DIF tests were statistically significant at .05 level when applying the false discovery procedure (Benjamini and Hochberg 1995; which is more powerful than the Bonferroni adjustment). Therefore, we concluded that, practically, all items function similarly across males and females. Similar results were found for DIF with respect to age, where changes in −2LL were 47.09 and 229.69 when considering those aged 22 or below ($n = 783$) and those aged 23 or above ($n = 286$), and RMSEA = .049, .049, and .046 indicated that the discrimination and threshold parameters were approximately equal across age groups.

Item Selection

As shown in Table 1, the estimated item discriminations for the 30 items were between 0.33 and 1.60, with 15 items having discriminations higher than 1.0. The empirical reliability for all 30 items was .954, and for 95% of the sample, the SE of the estimated θ was within 0.25. Most of the items had item information curve peaked in the range of $\theta = -2$ and $\theta = 2$. The test information curve for the full scale was shown in Fig. 1 (dashed line), with highest test information in the range between $\theta = -3$ and $\theta = 2$ and less information for $\theta > 2$ (but test information still > 10).

We then selected items based on their locations and item information in the range of $\theta = -3$ and $\theta = 3$, as well as their contributions to content coverage. If two items having high information demonstrated local dependence, such as item 19 and item 20, we opted to only select the one with higher information so that the resulting short scale is more unidimensional. As a result, we selected items 1, 2, 3, 5, 16, 18, 20, and 21, with the test information curve shown in Fig. 1 (solid line). The estimated marginal reliability for the shortened scale was 0.91, and test information was around 10 except for $\theta > 2$. The correlation between the trait level estimates using the full scale and the shortened scale was .944 (see Fig. 2). Therefore, we concluded that the eight-item short scale reflected the full scale of NAS well and demonstrated adequate internal consistency. The selected items were shown in Appendix 1.

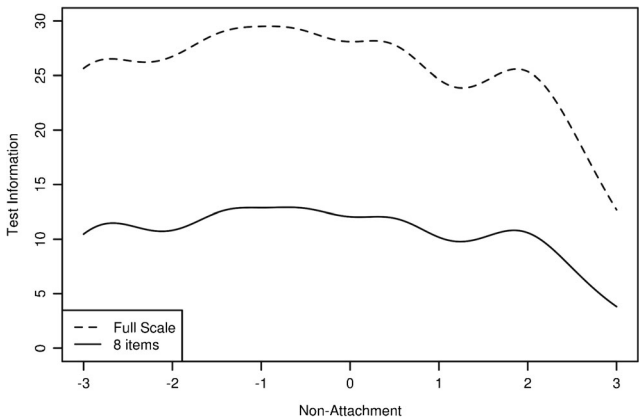

Fig. 1 Test information curve of the full scale and the shortened scale

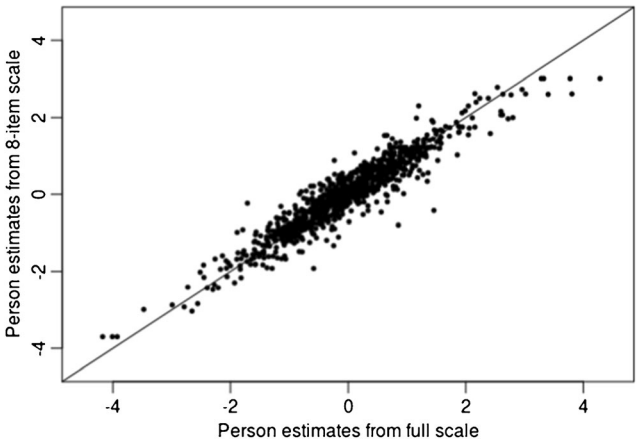

Fig. 2 Correlation between the latent trait estimates based on the full scale and those on the shortened scale

Study 2

Method

Participants

Participants comprised 393 college students, with 257 (65.4%) females. Their age ranged from 17 to 33, with a mean age of 20.45 years (SD = 2.37). A majority of the participants were undergraduate students ($N = 336$; 85.5%) and 57 (14.5%) of them were postgraduate students.

Procedures

Ethics approval was obtained from The Chinese University of Hong Kong, and participants were recruited via mass mail within the university. Upon informed consent, participants were asked to complete an online questionnaire. They were given HKD50 (~USD6) as incentives.

Measures

Peace of Mind Peace of mind was measured by the Peace of Mind Scale (PoM; Lee et al. 2013). It was an affective well-being valued in the Chinese culture and consisted of seven items that described the internal states of harmony and peacefulness. Participants rated the items on a 5-point Likert scale ranging from (1) *not at all* to (5) *all of the time*. Two items were reverse coded and higher scores reflect higher peace of mind. Its validity and reliability have been demonstrated among the Chinese population (Lee et al. 2013). Cronbach's alpha was .90 in the present study.

Well-Being Well-being was assessed using the 14-item Mental Health Continuum-Short Form (Keyes et al. 2008). The scale was derived from the original 39-item Mental Health Continuum (Keyes 2002). Participants rated the items from 1 (*never*) to 6 (*every day*) and the items consisted of psychological, social, and emotional well-being. Satisfactory reliability was shown (Cronbach alpha's for emotional, social, and psychological well-being were .90, .80, and .90, respectively) in the present study.

Anxiety The General Anxiety Disorder-7 (GAD-7; Spitzer et al. 2006) was used to measure level of anxiety. Satisfactory reliability and validity have been shown (Löwe et al. 2008). Participants rated the 7-item scale from 0 (*not at all*) to 3 (*nearly every day*), with higher scores indicating higher level of anxiety. Cronbach's alpha was .92 in the present study.

Depression Depression was measured using the Patient Health Questionnaire-9 (PHQ-9; Kroenke and Spitzer 2002). It has been validated in the Chinese community sample in Hong Kong with satisfactory reliability (Yu et al. 2012). Participants rated the items from 0 (*not at all*) to 3 (*nearly every day*) and higher scores indicate higher level of depression. Satisfactory reliability (Cronbach's alpha = .86) was demonstrated in the present study.

Stress The 10-item Perceived Stress Scale (PPS; Cohen et al. 1983) was used to assess level of stress. The scale comprised of two subscales: perceived helpfulness and perceived efficacy. Participants rated how often they had experienced the items in the past month from 1 (*never*) to 5 (*very often*). Good reliability and validity have been demonstrated (Ng 2013) and the Cronbach's alpha was .85 in the present study.

Compassion The 5-item Santa Clara Brief Compassion Scale (Hwang et al. 2008) was used to measure participants' compassion towards strangers. Participants were asked to rate the items that describe the compassion towards strangers on a 7-point Likert scale from 1 (*not at all true of me*) to 7 (*very true of me*). Satisfactory reliability was shown (Cronbach's alpha = .86).

Social Connectedness The 8-item Social Connectedness Scale (Lee and Robbins 1995) was used to measure the feeling of connectedness and interpersonal separation. The items were rated on a 6-point Likert scale ranging from (1) *strongly agree* to (6) *strongly disagree*. All the items were negatively worded and later reverse coded, with higher scores indicating higher social connectedness. Reliability was satisfactory (Cronbach's alpha = .94) in the present study.

Nonattachment Based on the long form NAS (Sahdra et al. 2010), the 8 items selected for the Nonattachment Scale - Short form (NAS-SF) found in study 1 were used. The scale demonstrated satisfactory reliability (Cronbach's alpha = .91) in the present study.

Mindfulness The Chinese version of the Five Facet Mindfulness Questionnaire (FFMQ-C; Hou et al. 2014) was used to assess the level of mindfulness. The scale consisted of 20 items derived from the 39-item Five Facet Mindfulness Questionnaire (Baer et al. 2006). The scale has been validated among Chinese college students and satisfactory reliability had been demonstrated (Hou et al. 2014). It consisted of five 4-item subscales, which are observing, describing, acting with awareness, nonjudging, and nonreacting. Participants rated the scale on a 5-point Likert scale ranging from 1 (*never or very rarely true*) to 5 (*very often or always true*). Satisfactory reliability (Cronbach's alpha = .74) was found in the present study.

Data Analyses

We tested the criterion validity of the eight-item NAS by conducting the Pearson's correlation analyses between nonattachment and mindfulness, mental well-being measures, psychological distress measures, and social/interpersonal measures.

Results

Model Fit

We evaluated again the model fit of the graded response model to the eight-item NAS-SF in the replication data. Whereas M_2^* could not be computed due to small degrees of freedom, we found no statistically significant evidence for item misfit when inspecting $S\text{-}\chi^2$ (with all $ps > .028$, which were not statistically significant after accounting for multiple testing). The test information curve also resembled the one in Fig. 1, with higher test information in the range of 3 SD below the sample mean to 2 SD above the sample mean for the latent trait (maximum test information = 15.2).

Criterion Validity

Criterion validity was established by examining the correlations of mindfulness, mental well-being measures, psychological distress measures, and social/interpersonal measures with the eight-item NAS-SF. As expected, the eight-item NAS-SF was positively correlated with mindfulness ($r = .54$, $p < .001$), with nonreacting showing the highest correlation among the five facets of mindfulness ($r = .54$, $p < .001$). It was also strongly correlated with mental well-being, with moderate to

high correlations shown with the three aspects of well-being (i.e., psychological, social, and emotional well-being, with *rs* = .46–.54). Nonattachment was also positively associated with peace of mind ($r = .54$, $p < .001$) but inversely correlated with psychological distress (i.e., stress, depression, and anxiety). Furthermore, consistent with the notion that nonattachment was different from being aloof or uncaring, it was found that nonattachment showed small to moderate positive correlation with compassion ($r = .24$, $p < .001$) and social connectedness ($r = .41$, $p < .001$). A summary of the correlation coefficients was shown in Table 2.

Discussion

In view of the need to establish an efficient, valid, and reliable scale to measure nonattachment, the main aim of the present study was to develop an abridged version of the NAS by examining the psychometric properties of the NAS using the IRT approach. The two studies demonstrated that the eight items derived from the original 30-item NAS showed satisfactory psychometric properties and validity similar to the long form NAS. Findings supported the utilization of the 8-item NAS-SF which showed satisfactory criterion validity and measurement precision among individuals with different level of nonattachment.

In particular, based on the cutoff suggested by Baker (2001), discrimination parameters of 0 to .24, .25 to .64, .65 to 1.34, 1.34 to 1.69, and above 1.7 are considered as very low, low, moderate, high, and very high, respectively. The IRT analyses in study 1 showed that many of the items in the original 30-item NAS showed moderate to high discrimination parameters, indicating that they are able to discriminate between people with different levels of nonattachment. However, items 4 (*I have a hard time appreciating others' successes when they outperform me*), 9 (*The amount of money I have is not important to my sense of who I am*), 13 (*If things aren't turning out the way I want, I get upset*), 24 (*I am often preoccupied by threats or fears*), and 26 (*I do not have to hang on to the people I love at all costs; I can let them go if they wish to go*) showed low discrimination parameters, with three out of these five items being the reverse-scored items. One study also found that the three negatively worded items and item 25 (*I am not possessive of the people I love*) showed misfit to the model using Rasch analysis (Feng et al. 2016). As argued by the authors, these negatively worded items could be difficult for participants to process, or the items did not reflect the opposite of nonattachment. They have concluded a 26-item NAS based on the Rasch analysis on the model fit. In the present study, although these items could fit in the model, we also found that these negatively worded items and item 9 and item 26 showed low discrimination parameters. These items were also relatively easy to endorse, indicating that even individuals who have very low level of nonattachment tended to score high on these items.

Results in the present study also showed that the pair of item 4 (*I have a hard time appreciating others' success when they outperform me*) and item 15 (*I can take joy in others' achievements without feeling envious*), the pair of item 19 (*I do not get "hung up" on wanting an "ideal" or "perfect" life*") and item 20 (*I am comfortable being an ordinary, less than perfect human being*), as well as the pair of item 25 (*I am not possessive of the people I love*) and item 30 (*I am not possessive of the things I owe*) showed local dependence, which indicated that participants' responses to these pairs of items were related to one another. This could be due to item similarity, as shown that the pairs of the items are similar in terms of the content. Nevertheless, we still found that the test information of the full scale as a whole were able to demonstrate measurement precision across a wide range of individuals with different levels of nonattachment, especially within individuals who scored 3 SD below to 2 SD above the mean of our sample on nonattachment. The full scale was also equally suitable for males and females.

As the main aim of the present study was to develop a short version of the NAS that could maximize the measurement precision and minimize the time needed to administer the scale, we have taken the test information and local independence into account in the reduction of the items. The reduction of the full scale to eight items showed similar psychometric properties. The 8-item NAS-SF was able to assess nonattachment over a wide continuum. Similar to the full scale, measurement precision of the 8-item NAS-SF was satisfactory across a wide range of the nonattachment level, but the

Table 2 Criterion validity: Pearson correlations between the 8-item NAS-SF and the related constructs

Scale	Correlation with 8-item NAS-SF
Mindfulness	.54**
Describing	.30**
Acting with awareness	.23**
Observing	.22**
Nonjudging	.16*
Nonreacting	.54**
Peace of mind	.54**
Well-being	.58**
Psychological well-being	.46**
Social well-being	.54**
Emotional well-being	.53**
Stress	− .57**
Depression	− .49**
Anxiety	− .53**
Social connectedness	.41**
Compassion	.24**

*$p < .01$, **$p < .001$

measurement precision started to decrease for individuals who have very high level of nonattachment (i.e., 2 SD above the mean).

The shortened version was also highly correlated with the full scale and study 2 showed satisfactory criterion validity of the 8-item NAS-SF. Consistent with previous studies that showed moderate correlation of the full scale of NAS with nonreactivity (Sahdra et al. 2010; Feliu-Soler et al. 2016), the present study also showed that the 8-item NAS-SF showed the highest correlation with nonreactivity among the five facets of mindfulness. As mindfulness involves the intentional awareness of the present moment with openness (Kabat-Zinn 1990; Baer et al. 2006), it was not surprising to find that the nonreactivity to inner experience, or the tendency to allow thoughts and feelings to come in and out without getting caught in them, was moderately correlated with nonattachment, which involves the "letting go" of mental fixations without having a pressure to change, avoid, or hold on to them. However, the nonjudgmental facet of mindfulness just showed small correlation with the 8-item NAS-SF, which was inconsistent with the previous findings that showed moderate correlation of the full scale NAS with the nonjudging facet of mindfulness in the Spanish sample (Feliu-Soler et al. 2016). While it is possible that being nonattached does not necessarily need to hold a nonevaluative stance to any experience, further studies are needed to examine the relationship between nonattachment and nonjudging facet in mindfulness.

Nevertheless, the present study replicated previous studies that showed the protective role of nonattachment against mental afflictions by demonstrating its moderate negative association with stress, anxiety, and depression, as well as its moderate positive association with mental well-being. In addition to showing that nonattachment is correlated with the presence of positive states, and the absence of negative states, the present study showed that nonattachment is also moderately associated with peace of mind, which is a low-arousal positive affect as characterized by an internal state of peacefulness and harmony (Lee et al. 2013). The findings also supported the notion that nonattachment is not being aloof and uncaring, as it showed small correlation with compassion and moderate correlation with social connectedness. Overall, most findings regarding the 8-item NAS-SF were consistent with the previous studies and the original validation, demonstrating that the abridged form was a valid and reliable measurement that could be applied to a wide range of individuals in an efficient way.

Limitations

There are several limitations in the present study. Findings in the current study mainly consisted of Hong Kong Chinese college students. To offset this limitation, item selection was selected based on an item's contribution to the test information across a wide range of trait levels of nonattachment. Future studies may further examine the psychometric properties in other samples and cultures. Also, it should be noted that the current study did not independently administer both the full scale and the 8-item NAS-SF to examine the correlation between the two scales as well as their correlations with the criterion variables. The correlation might be exaggerated when the scores of the 8-item version extracted from the full scale were correlated with the whole measurement without independently administering the two scales. Despite these limitations, the findings in the present study helped to provide a short form of the NAS which can be useful for rapid assessment, especially when the administration of long items is not feasible, with good measurement precision over a wide range of the nonattachment trait levels. As this concept of nonattachment is only recently introduced, more research will be needed to examine its longitudinal and causal impacts on well-being. Future studies can utilize the NAS-SF, which measures the level of NAS among people of differing level of nonattachment, to alleviate the burden of participants from responding to long questionnaire and to allow researchers to investigate this construct along with other mindfulness-related constructs more extensively in one questionnaire.

Author Contributions FHNC designed the study, analyzed the data, and wrote the manuscript. MHCL analyzed the data and wrote part of the results. WWSM conceived and designed the study, collected data, and edited the manuscript.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Informed Consent Ethical standards set forth by the Chinese University of Hong Kong Survey and Behavioral Research Ethics Committee were followed in conducting the study. The study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Informed consent from the participants was obtained upon explanation of the study.

Appendix 1

The 8-item NAS-SF selected based on the 30-item NAS developed by Sahdra et al. (2010).

1. I can accept the flow of events in my life without hanging onto them or pushing them away.
2. I can let go of regrets and feelings of dissatisfaction about the past.
3. I find I can be calm and/or happy even if things are not going my way.

5. I can remain open to what life offers me regardless of whether it seems desirable or undesirable at a particular time.

16. I find I can be happy almost regardless of what is going on in my life.

18. I am open to reflecting on my past mistakes and failings.

20. I am comfortable being an ordinary, less than perfect human being.

21. I can remain open to thoughts and feelings that come into my mind, even if they are negative or painful.

References

Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment, 13*(1), 27–45.

Baker, F. (2001). *The basics of item response theory*. College Park: ERIC Clearinghouse on Assessment and Evaluation, University of Maryland.

Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: a practical and powerful approach to multiple testing. *Journal of the Royal Statistical society, Series B (Methodological), 57*, 289–300.

Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., … Devins, G. (2004). Mindfulness: a proposed operational definition. *Clinical Psychology: Science and Practice, 11*, 230–241.

Brown, K. W., Ryan, R. M., & Creswell, J. D. (2007). Mindfulness: theoretical foundations and evidence for its salutary effects. *Psychological Inquiry, 18*(4), 211–237.

Cai, L., & Hansen, M. (2013). Limited-information goodness-of-fit testing of hierarchical item factor models. *British Journal of Mathematical and Statistical Psychology, 66*(2), 245–276.

Chalmers, R. P. (2012). Mirt: a multidimensional item response theory package for the R environment. *Journal of Statistical Software, 48*(6), 1–29.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*, 385–396.

Edwards, M. C., Wirth, R. J., Houts, C. R., & Bodine, A. J. (2015). Three (or four) factors, four (or three) models. In S. P. Reise & D. A. Revicki (Eds.), *Handbook of item response theory* (pp. 159–182). New York: Routledge.

Embretson, S. E., & Reise, S. P. (2000). *Item response theory for psychologists*. Mahwah: Lawrence Erlbaum.

Feliu-Soler, A., Soler, J., Luciano, J. V., Cebolla, A., Elices, M., Demarzo, M., & García-Campayo, J. (2016). Psychometric properties of the Spanish version of the Nonattachment Scale (NAS) and its relationship with mindfulness, decentering, and mental health. *Mindfulness, 7*(5), 1156–1169.

Feng, X. J., Krägeloh, C. U., Medvedev, O. N., Billington, D. R., Jang, J. Y., & Siegert, R. J. (2016). Assessing mechanisms of mindfulness: Improving the precision of the Nonattachment Scale using a Rasch model. *Mindfulness, 7*, 1082–1091.

Finney, S. J., & DiStefano, C. (2013). Non-normal and categorical data in structural equation modeling. In G. R. Hancock & R. O. Mueller (Eds.), *Structural equation modeling: a second course* (2nd ed., pp. 439–492). Charlotte: Information Age.

Hou, J., Wong, S. Y. S., Lo, H. H. M., Mak, W. W. S., & Ma, H. S. W. (2014). Validation of a Chinese version of the Five Facet Mindfulness Questionnaire in Hong Kong and development of a short form. *Assessment, 21*(3), 363–371.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*, 1–55.

Hwang, J. Y., Plante, T., & Lackey, K. (2008). The development of the Santa Clara brief compassion scale: an abbreviation of Sprecher and Fehr's Compassionate Love Scale. *Pastoral Psychology, 56*(4), 421–428.

Ju, S. J., & Lee, W. K. (2015). Mindfulness, non-attachment, and emotional well-being in Korean adults. *Advanced Science and Technology Letters, 87*, 68–72.

Kabat-Zinn, J. (1990). *Full catastrophe living: Using the wisdom of your mind and body to face stress, pain, and illness*. New York: Delacorte.

Keyes, C. L. (2002). The Mental Health Continuum: from languishing to flourishing in life. *Journal of Health and Social Behavior, 43*, 207–222.

Keyes, C. L., Wissing, M., Potgieter, J. P., Temane, M., Kruger, A., & van Rooy, S. (2008). Evaluation of the Mental Health Continuum-Short Form (MHC-SF) in Setswana-speaking South Africans. *Clinical Psychology and Psychotherapy, 15*(3), 181.

Kroenke, K., & Spitzer, R. L. (2002). The PHQ-9: a new depression diagnostic and severity measure. *Psychiatric Annals, 32*(9), 509–515.

Lamis, D. A., & Dvorak, R. D. (2014). Mindfulness, nonattachment, and suicide rumination in college students: the mediating role of depressive symptoms. *Mindfulness, 5*, 487–496.

Lee, R. M., & Robbins, S. B. (1995). Measuring belongingness: the Social Connectedness and the Social Assurance Scales. *Journal of Counseling Psychology, 42*(2), 232.

Lee, Y. C., Lin, Y. C., Huang, C. L., & Fredrickson, B. L. (2013). The construct and measurement of peace of mind. *Journal of Happiness Studies, 14*(2), 571–590.

Löwe, B., Decker, O., Müller, S., Brähler, E., Schellberg, D., Herzog, W., & Herzberg, P. Y. (2008). Validation and standardization of the Generalized Anxiety Disorder Screener (GAD-7) in the general population. *Medical Care, 46*(3), 266–274.

Mclntosh, W. D. (1997). East meets West: parallels between Zen Buddhism and social psychology. *The International Journal for the Psychology of Religion, 7*, 37–52.

Millsap, R. E. (2011). *Statistical approaches to measurement invariance*. New York: Routledge.

Ñanamol, B., & Bodhi, B. (1995). *The middle length discourses of the Buddha: a translation of the Majjhima Nikāya*. Somerville: Wisdom Publications.

Ng, S. M. (2013). Validation of the 10-item Chinese Perceived Stress Scale in elderly service workers: one-factor versus two-factor structure. *BMC Psychology, 1*(1), 9.

Orlando, M., & Thissen, D. (2000). Likelihood-based item-fit indices for dichotomous item response theory models. *Applied Psychological Measurement, 24*(1), 50–64.

Orlando, M., & Thissen, D. (2003). Further investigation of the performance of S-X^2: an item fit index for use with dichotomous item response theory models. *Applied Psychological Measurement, 27*(4), 289–298.

Revelle, W. (2017). Psych: Procedures for Personality and Psychological Research [computer software]. Retrieved from https://CRAN.R-project.org/package=psych Version = 1.7.5.

Revicki, D. A., Chen, W. H., & Tucker, C. (2015). Developing item banks for patient-reported health outcomes. In S. P. Reise & D. A. Revicki (Eds.), *Handbook of item response theory* (p. 334). New York: Routledge.

Sahdra, B. K., Shaver, P. R., & Brown, K. W. (2010). A scale to measure nonattachment: a Buddhist complement to Western research on

attachment and adaptive functioning. *Journal of Personality Assessment, 92*, 116–127.

Sahdra, B. K., Ciarrochi, J., Parker, P. D., Marshall, S., & Heaven, P. (2015). Empathy and nonattachment independently predict peer nominations of prosocial behavior of adolescents. *Frontiers in Psychology, 6*, 263.

Sahdra, B., Ciarrochi, J., & Parker, P. (2016). Nonattachment and mindfulness: related but distinct constructs. *Psychological Assessment, 28*(7), 819.

Samejima, F. (1969). Estimation of latent ability using a response pattern of graded scores. *Psychometrika, 35*(1), 139.

Samejima, F. (1997). Graded response model. In W. J. van der Linden & R. K. Hambleton (Eds.), *Handbook of item response theory* (pp. 85–100). New York: Springer.

Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of Internal Medicine, 166*(10), 1092–1097.

Tran, U. S., Cebolla, A., Glück, T. M., Soler, J., Garcia-Campayo, J., & Von Moy, T. (2014). The serenity of the meditating mind: a cross-cultural psychometric study on a two-factor higher order structure of mindfulness, its effects, and mechanisms related to mental health among experienced meditators. *PLoS One, 9*(10), e110192.

Wang, S. Y., Wong, Y. J., & Yeh, K. H. (2016). Relationship harmony, dialectical coping, and nonattachment: Chinese indigenous well-being and mental health. *The Counseling Psychologist, 44*(1), 78–108.

Yu, X., Tam, W. W., Wong, P. T., Lam, T. H., & Stewart, S. M. (2012). The Patient Health Questionnaire-9 for measuring depressive symptoms among the general population in Hong Kong. *Comprehensive Psychiatry, 53*(1), 95–102.

Zhao, S. H., & Chen, B. H. (2013). Validation of the Non-attachment Scale in a Taiwanese sample. *Bulletin of Educational Psychology, 45*, 121–139.