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A psychometric validation of contextual cognitive behavioral therapy-informed measures with racially and ethnically diverse adults

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ABSTRACT

The Five Facet Mindfulness Questionnaire (FFMQ), Engaged Living Scale (ELS), and Acceptance and Action Questionnaire-II (AAQ-II) are three commonly used contextual cognitive behavioral therapy (CBT)-informed self-report questionnaires. The present study aimed to psychometrically validate these three scales with racially and ethnically diverse adults in Hawai'i ($N = 1102$). Using a cross-validation strategy with an iterative process of exploratory and confirmatory factor analyses, findings revealed that factor structures of the FFMQ, ELS, and AAQ-II were theoretically consistent with extant literature. However, we also found slight factorial structure differences in the present sample, which may have practical implications when assessing these constructs within racially and ethnically diverse adults. Evidence of reliability, convergent validity, and measurement invariance of these scales are also provided. Implications and limitations of these findings are discussed.

As exemplified by the growing popularity of contextual cognitive behavioral therapies (CBTs; Hayes et al., 2011; Hofmann & Hayes, 2019) in recent years, the field of behavioral health has expanded its emphasis from an exclusive focus on symptom reduction to also elucidating generalized processes of change for optimal health and well-being. Salient examples of contextual CBTs include acceptance and commitment therapy (ACT; Hayes et al., 2012), dialectical behavior therapy (DBT; Linehan, 1993), and mindfulness-based cognitive therapy (MBCT; Segal et al., 2013). Recent reviews (e.g., Dimidjian et al., 2016) have shown that these interventions are clinically effective for individuals with a wide range of behavioral health concerns in part through promoting salutary processes of change, such as *mindfulness*, *engaged living*, and *psychological flexibility*, or through undermining problematic processes, such as *psychological inflexibility*.

However, empirical investigation of contextual CBTs remains limited for racially and ethnically diverse groups of adults in the U.S. (Cheng & Sue, 2014; Masuda, 2020). One way to facilitate contextual CBT research with these understudied groups is to psychometrically validate self-report measures of key contextual CBT-related constructs with them. Although these tasks are especially challenging, in part, due to systemic barriers to research with racially and ethnically diverse groups (e.g., mistrust of researchers, bias in academia), these validation efforts offer potential to reduce racial and ethnic disparities in contextual CBT research by increasing the psychometric precision and validity with which relevant constructs are measured within racially and ethnically diverse groups. As such, this study aimed to psychometrically examine the Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2008), Engaged Living Scale (ELS; Trompetter et al., 2013), and Acceptance and Action Questionnaire-II (AAQ-II; Bond et al., 2011), three commonly used contextual CBT-informed self-report measures, with racially and ethnically diverse adults in Hawai'i. As discussed elsewhere (e.g., Lim et al., 2019), studying a sample representative of a Hawai'i-based population may be particularly suitable for this research aim, as it reflects future trends in racial and ethnic diversity within the U.S. (U.S. Census Bureau, 2010, 2012, 2019).

1. Five Facet Mindfulness Questionnaire (FFMQ)

In contextual CBT literature, mindfulness has been theorized as an adaptive psychological process of regulating attention and experiencing internal events (i.e., thoughts, feelings) openly and nonjudgmentally (Hayes et al., 2011; Hayes & Hofmann, 2018). To date, one of the most

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thoroughly investigated self-report measures of mindfulness is the FFMQ (Baer et al., 2008). The development of the FFMQ was based on an aggregation of items from commonly used mindfulness self-report questionnaires at the time of its development (Baer et al., 2006). In the original validation study, an exploratory factor analysis (EFA) with a sample of undergraduate students revealed five distinct facets of mindfulness, which were labeled as: (a) *observing*, attending to, or noticing experience in a particular moment; (b) *describing*, recognizing, and labeling emotional states; (c) *acting with awareness*; (d) *nonjudging of inner experience*; and (e) *nonreactivity to inner experience*. Subsequently, the items with the highest factor loadings were taken from each factor to form a 39-item questionnaire, which was then tested using confirmatory factor analyses (CFAs) with another sample of undergraduate students. Results of CFAs showed that a hierarchical four-factor model removing the *observing* factor demonstrated the best fit of the data for that sample. Subsequently, Baer et al. (2008) found that a hierarchical five-factor model demonstrated the best fit of the data for a sample of non-meditators and meditators combined. To date, the psychometric properties of the FFMQ have been extensively examined and replicated in subsequent research with predominantly White American/European samples (e.g., Christopher et al., 2012; Williams et al., 2014).

2. Engaged Living Scale (ELS)

Engaged living is theorized as a behavioral process of constructing and explicating personally meaningful values, combined with engagement in values-consistent actions (Hayes et al., 2011; Hayes & Hofmann, 2018). The ELS (Trompetter et al., 2013) is one self-report measure developed to assess this construct. In the original validation study, Trompetter et al. examined ELS scores with a non-clinical sample of adults and a clinical sample of adult patients with chronic pain in the Netherlands. Results of an EFA with the non-clinical sample revealed a two-factor solution, and they labeled the two factors, *valued living* and *life fulfillment*. A CFA with the chronic pain sample subsequently found that a bifactor model with one overarching factor demonstrated the best fit of the data. Additionally, scores of the ELS and its subscales demonstrated consistent patterns of relationships with theoretically related constructs, such as psychological well-being, facets of mindfulness, and psychological flexibility. Trindade et al. (2016) then examined the psychometric properties of the ELS with a sample of Portuguese college students and found that a two-factor model from the original ELS study benefitted from omitting redundant items, which resulted in a 9-item version. However, Trindade et al. found that both versions demonstrated adequate fit to their data.

3. Acceptance and Action Questionnaire-II (AAQ-II)

The AAQ-II (Bond et al., 2011) is purported to be a self-report measure of *psychological inflexibility,* which is conceptualized as diminished values-based living due to maladaptive cognitive and behavioral efforts to down-regulate unwanted internal events with which one is excessively fused (Hayes et al., 2012). To date, the AAQ-II has consistently demonstrated a unidimensional factor structure in samples of predominantly White American/European participants (e.g., Fledderus et al., 2012; Gloster et al., 2011). However, a growing body of evidence has suggested a lack of measurement equivalence across racial and ethnic groups in the U.S. (Borgogna et al., 2020) and questionable construct validity (e.g., Cherry et al., 2021; Wolgast, 2014). Nevertheless, as the AAQ-II remains one of the most commonly used contextual CBT-informed self-report measures in research and practice (Tyndall et al., 2019), further investigation of the psychometric properties of this measure, especially with racially and ethnically diverse samples, may be warranted (Ong et al., 2019).

4. Present study

In an effort to narrow the disparities that racially and ethnically diverse samples face in CBS research and increase the utility of self-report measures of CBS-related constructs in diverse research and clinical settings, we examined and psychometrically validated the FFMQ, ELS, and AAQ-II, with racially and ethnically diverse adults in Hawai'i. As noted above, studying an adult sample representative of a Hawai'i-based population is particularly suitable for the present research aim because this group represents future trends of racial and ethnic diversity in the U.S.

5. Method

5.1. Participants

Participants for this study were adults recruited from undergraduate psychology courses in a large public university in Hawai'i from January 2018 to December 2020. They completed an online survey that included self-report questionnaires used for the present study and received extra credit in their courses as compensation for participation. To ensure response validity, four validity-check items were placed evenly throughout the survey. For a participant's data to be considered valid, correct responses to all four validity-check items were required; only valid participant data were utilized for study analyses.

Of a total of 1402 participants, data from 300 (21.4%) were found to be invalid, leaving $N = 1102$ (n *women* $= 780$) of valid participants' data. Individuals who identified their gender as 'Other' were excluded from analyses when gender was involved due to limitations in sample size in that category. There were no statistically significant differences between the valid and invalid groups on age or race/ethnicity. However, the invalid group tended to have a significantly greater proportion of men to women than the valid group. Additionally, the valid group had significantly higher scores on several individual items, with differences in favor of the valid group possessing greater mindfulness and engaged living, and less psychological inflexibility (see Table 1 for sample description). For the valid group, the average age of participants was 20.3 years ($SD = 4.03$; range = 18–55). The most common self-reported race/ethnicities of participants with valid data were: Asian ($n = 420$, 38.0%), multiracial ($n = 264$, 24.0%), and White (non-Hispanic; $n = 270$, 24.5%). This racial and ethnic group composition in the final sample was comparable to that of the state of Hawai'i, which is 37.6% Asian, 24.2% multiracial, and 25.5% non-Latinx White (U.S. Census Bureau, 2019).

For the present study's cross-validation analyses, the entire sample of valid participant data was randomly split into two halves ($Ns = 551$), hereafter referred to as Sample 1 and Sample 2. There were no statistically significant differences between Sample 1 and Sample 2 in terms of gender ($\chi^2 = 0.51$, $p = .48$), age ($F = 0.47$, $p = .49$), ethnicity ($\chi^2 = 4.71$, $p = .79$), nor scores on any of the FFMQ ($Fs < 2.78$, $ps > .10$), ELS ($Fs < 1.23$, $ps > .27$), nor AAQ-II ($Fs < 1.55$, $ps > .21$), items.

5.2. Study procedures and measures

The current study was approved by the Institutional Review Board of the authors' affiliated academic institution. After participants provided informed consent, they anonymously completed the survey that contained the following measures.

Demographic Form. The demographic questionnaire included questions regarding gender, race/ethnicity, and age. More specifically, gender was coded as 1 (male) or 2 (female). Race/ethnicity was identified in terms of the following categories: Native American, Latinx, Asian, Pacific Islander, White, Black, Hawaiian, Other, or Multiracial. Participants were instructed to select the race/ethnicity category that best described them. Age was coded as a continuous variable.

Additionally, to compare across potential subscales for each of the

Table 1
Sample description of invalid and valid data ($N = 1402$).

Characteristics	Invalid (n = 300)	Valid (n = 1102)	Statistical Test
	Mean (sd) or n, %	Mean (sd) or n, %	
Age (years)	19.9 (5.9)	20.3 (4.0)	$F(1, 1374) = 1.3$, $p = .24$
Missing	14 (0.5%)	12 (0.01%)	
Gender			**$\chi^2(1) = 10.7$, $p = .0011$**
Female	**176 (58.7%)**	**780 (70.8%)**	
Male	**112 (37.3%)**	**317 (28.8%)**	
Missing	12 (4%)	5 (0.4%)	
Ethnicity			$\chi^2(8) = 15.4$, $p = .0513$
Native American	2 (0.7%)	4 (0.4%)	
Latinx	20 (6.7%)	63 (5.7%)	
Asian	91 (30.3%)	420 (38.0%)	
Pacific Islander	9 (3.0%)	26 (2.4%)	
White (non-Hispanic)	75 (25.0%)	270 (24.5%)	
Black (non-Hispanic)	8 (2.7%)	16 (1.5%)	
Native Hawaiian	16 (5.3%)	33 (3.0%)	
Other	5 (1.7%)	6 (0.5%)	
Multi-racial	64 (21.3%)	264 (24.0%)	
Missing	10 (3.3%)	0 (0.0%)	
Five Facet Mindfulness Questionnaire			($df = 1, 1368$)
Item 1	2.70 (1.00)	2.71 (1.14)	$F = 0.0$, $p = .8380$
Item 2	**2.92 (0.89)**	**3.14 (1.06)**	**$F = 9.8$, $p = .0018$**
Item 3	3.07 (1.07)	3.02 (1.15)	$F = 0.5$, $p = .4719$
Item 4	**2.86 (0.96)**	**2.99 (0.91)**	**$F = 4.2$, $p = .0399$**
Item 5	**2.84 (1.01)**	**2.68 (1.06)**	**$F = 4.6$, $p = .0325$**
Item 6	2.86 (1.05)	2.79 (1.13)	$F = 0.8$, $p = .3778$
Item 7	**2.97 (0.98)**	**3.32 (1.00)**	**$F = 26.7$, $p < .0001$**
Item 8	3.02 (1.02)	3.13 (1.07)	$F = 2.4$, $p = .1224$
Item 9	2.94 (0.91)	2.94 (0.94)	$F = 0.0$, $p = .9863$
Item 10	3.04 (1.03)	2.97 (1.09)	$F = 0.7$, $p = .3924$
Item 11	2.88 (1.01)	3.03 (1.02)	$F = 3.6$, $p = .0594$
Item 12	3.04 (0.95)	3.18 (1.04)	$F = 3.8$, $p = .0504$
Item 13	2.78 (0.98)	2.71 (1.10)	$F = 0.9$, $p = .3451$
Item 14	3.10 (1.01)	3.18 (1.16)	$F = 1.3$, $p = .2624$
Item 15	**3.03 (1.06)**	**3.23 (1.10)**	**$F = 7.1$, $p = .0076$**
Item 16	3.04 (1.01)	3.15 (1.04)	$F = 2.5$, $p = .1111$
Item 17	**2.97 (0.97)**	**2.80 (1.03)**	**$F = 5.9$, $p = .0157$**
Item 18	3.00 (0.92)	3.13 (1.05)	$F = 3.6$, $p = .0579$
Item 19	3.01 (0.95)	3.03 (0.97)	$F = 0.1$, $p = .8294$
Item 20	3.10 (1.03)	3.22 (1.11)	$F = 2.2$, $p = .1363$
Item 21	2.99 (0.94)	3.10 (0.91)	$F = 3.3$, $p = .0681$
Item 22	**3.23 (0.94)**	**3.41 (0.99)**	**$F = 7.7$, $p = .0056$**
Item 23	**3.10 (1.02)**	**3.24 (0.93)**	**$F = 4.0$, $p = .0471$**
Item 24	**2.82 (0.99)**	**2.64 (1.00)**	**$F = 6.9$, $p = .0085$**
Item 25	3.06 (0.98)	3.10 (1.05)	$F = 0.2$, $p = .6530$
Item 26	**3.18 (1.02)**	**3.57 (1.03)**	**$F = 31.4$, $p < .0001$**
Item 27	**2.89 (0.93)**	**3.06 (1.02)**	**$F = 6.4$, $p = .0119$**
Item 28	3.16 (0.87)	3.24 (0.93)	$F = 1.5$, $p = .2201$
Item 29	2.88 (0.93)	2.89 (0.91)	$F = 0.1$, $p = .8304$
Item 30	3.15 (0.99)	3.24 (1.06)	$F = 1.7$, $p = .1912$
Item 31	**3.15 (0.99)**	**3.34 (1.13)**	**$F = 6.3$, $p = .0121$**
Item 32	2.95 (0.99)	3.07 (1.07)	$F = 2.7$, $p = .0979$
Item 33	2.87 (0.92)	2.75 (0.94)	$F = 3.6$, $p = .0556$
Item 34	**3.15 (0.94)**	**3.29 (0.94)**	**$F = 5.0$, $p = .0256$**
Item 35	3.20 (0.97)	3.19 (1.01)	$F = 0.0$, $p = .9071$
Item 36	**3.16 (0.90)**	**3.52 (0.92)**	**$F = 32.2$, $p < .0001$**
Item 37	2.94 (0.94)	3.01 (1.01)	$F = 0.9$, $p = .3387$
Item 38	**3.03 (0.93)**	**3.19 (1.01)**	**$F = 5.3$, $p = .0211$**
Item 39	3.14 (1.01)	3.11 (1.09)	$F = 0.2$, $p = .6263$
Engaged Living Scale			($df = 1, 1370$)
Item 1	**3.60 (1.11)**	**4.12 (0.80)**	**$F = 77.1$, $p < .0001$**
Item 2	**3.64 (1.00)**	**3.92 (0.93)**	**$F = 19.8$, $p < .0001$**
Item 3	**3.66 (0.98)**	**4.01 (0.84)**	**$F = 35.2$, $p < .0001$**
Item 4	3.18 (1.08)	3.11 (1.15)	$F = 0.8$, $p = .3723$
Item 5	**3.56 (1.00)**	**3.80 (0.81)**	**$F = 16.1$, $p < .0001$**
Item 6	**3.61 (1.01)**	**3.78 (0.96)**	**$F = 7.2$, $p = .0073$**
Item 7	3.27 (1.02)	3.32 (1.11)	$F = 0.4$, $p = .5344$
Item 8	**3.65 (0.94)**	**3.86 (0.82)**	**$F = 13.9$, $p = .0002$**
Item 9	**3.51 (0.99)**	**3.77 (0.88)**	**$F = 19.0$, $p < .0001$**
Item 10	3.19 (1.03)	3.19 (1.08)	$F = 0.0$, $p = .9280$
Item 11	3.27 (1.00)	3.16 (1.06)	$F = 2.7$, $p = .1021$
Item 12	3.37 (0.99)	3.42 (1.04)	$F = 0.4$, $p = .5091$
Item 13	**3.44 (1.02)**	**3.64 (1.02)**	**$F = 7.6$, $p = .0060$**
Item 14	**3.13 (1.07)**	**2.96 (1.17)**	**$F = 5.0$, $p = .0260$**
Item 15	**3.67 (0.97)**	**3.98 (0.83)**	**$F = 27.0$, $p < .0001$**
Item 16	3.32 (1.06)	3.36 (1.11)	$F = 0.3$, $p = .5943$
Acceptance and Action Questionnaire-II			($df = 1, 1370$)
Item 1	**3.32 (1.59)**	**3.04 (1.59)**	**$F = 6.5$, $p = .0109$**
Item 2	**3.67 (1.58)**	**3.40 (1.68)**	**$F = 5.4$, $p = .0199$**
Item 3	3.68 (1.59)	3.62 (1.76)	$F = 0.3$, $p = .5952$
Item 4	**3.39 (1.58)**	**2.88 (1.59)**	**$F = 22.1$, $p < .0001$**
Item 5	3.80 (1.51)	3.72 (1.65)	$F = 0.6$, $p = .4551$
Item 6	3.94 (1.55)	4.13 (1.77)	$F = 2.7$, $p = .1010$
Item 7	3.89 (1.54)	3.91 (1.71)	$F = 0.0$, $p = .8564$

Note. All statistically significant valid-invalid group comparisons ($p < .05$) are denoted in Bold. Mean scores are reported for all measures; however, response scales differ across measures, with the AAQ-II using a 7-point Likert scale and the FFMQ and ELS use 5-point Likert scales.

three measures examined, our composite scores for the following measures were based on mean ratings rather than sums, and the overall composite was the mean of the factor scores.

Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006). The FFMQ is a 39-item self-report questionnaire assessing five domains of mindfulness, including *observing, describing, non-reactivity, non--judging,* and *acting with awareness.* Statements are evaluated using a Likert scale ranging from 1 to 5, with 1 meaning, "*Never or very rarely true"* and 5 meaning, "*Very often or always true."* Higher scores indicate greater levels of mindfulness. Previous research (e.g., Baer et al., 2008) has provided evidence of construct validity in terms of five factors and one superordinate factor, as well as good internal consistency (α = 0.75 - 0.91). Scores of the FFMQ have also been shown to demonstrate incremental validity in the prediction of mental health concerns, as well as convergent validity in terms of correlations with theoretically expected measures (Baer et al., 2008).

Engaged Living Scale (ELS; Trompetter et al., 2013). The ELS is a 16-item self-report measure of engaged, or values-based, living and

contains two subscales: *valued living* and *life fulfillment*. Items are rated using a Likert scale ranging from 1 to 5, with 1 indicating, "*Completely disagree,*" and 5 indicating, "*Completely agree.*" Higher scores indicate greater levels of engaged living. Scores of the ELS have been found to demonstrate good internal consistency as well as strong evidence of construct validity and predictive validity in Dutch adult (Trompetter et al., 2013) and Portuguese emerging adult (Trindade et al., 2016) samples.

Acceptance and Action Questionnaire-II (Bond et al., 2011). The AAQ-II is a 7-item self-report questionnaire designed to measure *psychological inflexibility* (Bond et al., 2011). Items are rated using a Likert scale ranging from 1 to 7, with 1 corresponding to, "*Never true,*" and 7 corresponding to, "*Always true.*" Higher scores reflect greater levels of psychological inflexibility. Previous research has consistently provided evidence of a unidimensional factor structure (e.g., Bond et al., 2011; Fledderus et al., 2012), as well as evidence of adequate internal consistency and predictive validity for the AAQ-II (Bond et al., 2011; Masuda et al., 2017).

5.3. Data analytic strategy

CFA, EFA, and measurement invariance analyses were performed using Mplus Version 8.5 (Muthén & Muthén, 2017). Factor analyses were conducted using weighted least square mean and variance adjusted (WLSMV) estimation (Beauducel & Herzberg, 2006). Consistent with previous research (e.g., Immekus & Imbrie, 2010; Mogle et al., 2017), a cross-validation strategy was utilized in which theory-driven CFAs were conducted using the entire sample. If no acceptable structural model fit was found, EFAs and CFAs were conducted on Sample 1 (i.e., exploratory analyses), and CFAs were subsequently implemented with Sample 2 to verify and confirm the factor structures elucidated in the EFAs from Sample 1. Finally, using the entire sample to adequately power measurement invariance analyses (Meade & Lautenschlager, 2004), final CFA structural models from all three measures were examined for measurement invariance among ethnicity (Asian, White, and All Others) and gender (male and female) groups, respectively, across varying levels of invariance (i.e., configural, metric, scalar, strict).

A model was considered to have good or acceptable fit based on goodness-of-fit statistics, with attention primarily given to RMSEA and CFI. An RMSEA value of less than 0.06 indicates excellent model fit, a range of 0.06–0.08 indicates good model fit (Hooper et al., 2008), and a range of 0.08–0.10 indicates mediocre, or tentative, model fit (Browne & Cudeck, 1992; Hu & Bentler, 1999). An acceptable cutoff for CFI is 0.95 or greater (Hu & Bentler, 1999). Other goodness-of-fit statistics assessed included chi-square, Standardized Root Mean Square Residual (SRMR), and the Tucker–Lewis Index (TLI). The acceptable cutoff value for SRMR was 0.08 or less, with a value of 0.06 or less indicating excellent model fit. Similar to the CFI, the acceptable cutoff value for the TLI was 0.95 or greater (Hooper et al., 2008).

Internal consistency measures (i.e., standardized Cronbach's alpha & McDonald's omega) were also calculated with the entire sample using JASP software (JASP Team, 2022). The acceptable cutoff for the standardized Cronbach alpha and McDonald's omega was set at 0.70 or greater. Lastly, the construct (i.e., convergent and divergent) validity of the FFMQ, ELS, and AAQ-II was examined through the calculation and evaluation of inter-scale and inter-factor correlations. Based on the salutary nature of the processes of mindfulness and engaged living, along with the psychopathological process of psychological inflexibility, it was expected that the composite (and subscale) FFMQ scores would be positively correlated with aggregate (and subscale) ELS scores, and that both these measures (and subscales) would be negatively correlated with AAQ-II scores.

6. Results

6.1. FFMQ structural psychometric models

For the FFMQ, theory-driven CFAs were initially conducted with the entire sample. Model fit indices were assessed for the null model (i.e., all items uncorrelated), one-factor CFA model, and five-factor CFA models. The five-factor models were based on existing theories, which suggested that a model with five distinct factors (i.e., *observing, describing, non-reactivity, non-judging, and acting with awareness*), as well as a five-factor model with a superordinate factor subsuming four of the five factors, excluding the *observing* factor, would best conceptualize the FFMQ (Baer et al., 2006, 2008). None of these models demonstrated good fit of the data (see Table 2). Subsequently, EFAs were conducted on Sample 1 and based on goodness-of-fit statistics and meaningfulness of factors, a five-factor model that retained all 39 original FFMQ items was preliminarily selected as our base model ($\chi^2 = 1826.9$, $df = 556$, $p < .0001$; RMSEA = 0.06, CFI = 0.94).

Following the EFAs with Sample 1, a CFA was conducted with Sample 2 to confirm the FFMQ factor structure derived from the base model. However, this five-factor CFA did not fit the data well ($\chi^2 = 3362.2$, $df = 655$, $p < .0001$; RMSEA = 0.09, CFI = 0.88). Consultation of the residual covariance matrix indicated a suboptimal paucity of zero or near zero residuals (i.e., numerous covariations that were not well accounted for), which confirmed that the model fit was not adequate. Further inspection of the covariance matrix and modification indices also suggested that a six-factor model with a general (i.e., G) factor (bi-factor model; Holzinger & Swineford, 1937; Morin et al., 2016) would result in a better model fit via accounting for a greater proportion of residual covariance. In the proposed six-factor model, four factors were identical in terms of specific items to *observing, describing, non-reactivity, non-judging* subscales from the original FFMQ. However, items from the original *acting with awareness* subscale were further parsed into two distinct factors. The first of which was defined by four items (i.e., Items 5, 8, 13, and 18) assessing the extent to which respondents are not easily distracted or remain in contact with present-moment experience, and we labeled this factor *non-distractibility*. The second factor was derived from four items (i.e., Items 23, 28, 34, and 38) that highlight the extent to which one is engaging in daily activities mindfully or attentively, and we termed this factor *non-autopilot*. Additionally, three items within the *describing* factor (i.e., Items 12, 16, and 22) contained negative factor loadings; in the interest of CFA parsimony, these items were dropped. The six-factor CFA model with a general factor was then tested again using CFA on Sample 2 and demonstrated acceptable fit to the data ($\chi^2 = 1531.5$, $df = 543$, $p < .0001$; RMSEA = 0.06, CFI = 0.94). Thus, the six-factor CFA model with a general factor, dropping Items 12, 16, and 22, was selected as the best-fitting model for the FFMQ and utilized for all subsequent analyses (see Table 2 and Fig. 1).

6.2. ELS structural psychometric models

For the ELS, theory-driven CFAs were first conducted with the entire sample. Model fit indices were assessed for the null model (i.e., all items uncorrelated), one-factor CFA model, and two-factor CFA model of the ELS (both with and without a superordinate factor). The two-factor models were based on existing theories, which suggested two factors with Factor 1 (i.e., *valued living*) comprised of Items 1–10, and Factor 2 (i.e., *life fulfillment*) comprised of Items 11–16 (Trompetter et al., 2013). Due to poor model fit of these models (see Table 2), EFAs were conducted on Sample 1. Based on goodness-of-fit statistics and meaningfulness of factors, a four-factor model that retained all 16 original items was selected as our base model ($\chi^2 = 232.6$, $df = 62$, $p < .0001$; RMSEA = 0.07, CFI = 0.99).

Within the base model, the first factor was reflected in four items (i.e., Items 1, 2, 3, and 5) assessing respondents' recognition of values that give them personal meaning in life, and we termed this factor *recognizing*

Table 2
Summary of confirmatory factor analyses (CFAs) and exploratory factor analyses (EFAs).

Model	Sample	χ^2	*df*	SRMR	CFI	TLI	RMSEA	Model Fit Decision
Five Facet Mindfulness Questionnaire: CFA Models								
Null hypothesis with a @0 correlation	1 & 2 combined	45,247.2*	741	.262	.000	.000	.233	Poor or unacceptable
The general single-factor model	1 & 2 combined	22,589.0*	702	.162	.508	.481	.168	Poor or unacceptable
CFA based on existing theories: Hierarchical four-factor model with *Observing* factor separate	1 & 2 combined	8415.1*	697	.105	.827	.816	.100	Poor or unacceptable
CFA based on existing theories: Baer et al. (2006) Five-factor model	1 & 2 combined	6504.1*	692	.079	.869	.860	.087	Acceptable RMSEA, Poor or unacceptable CFI/TLI
Five Facet Mindfulness Questionnaire: Additional Cross Validation Models								
Five-factor EFA model	Sample 1	1826.9*	556	.036	.941	.921	.064	Good or acceptable CFI and RMSEA
Five-factor CFA model	Sample 2	3362.2*	655	.082	.875	.866	.087	Acceptable RMSEA, Poor or unacceptable CFI/TLI
Six-factor CFA with general (G) factor, dropping items 12, 16, & 22	Sample 2	1531.5*	543	.044	.950	.942	.057	Good or acceptable CFI and RMSEA
Engaged Living Scale: CFA Models								
Null hypothesis with a @0 correlation	1 & 2 combined	32,256.7*	120	.407	.000	.000	.493	Poor or unacceptable
The general single-factor model	1 & 2 combined	5145.9*	104	.100	.843	.819	.210	Poor or unacceptable
CFA based on existing theories: Two-factor model	1 & 2 combined	3676.4*	103	.081	.889	.870	.177	Poor or unacceptable
CFA based on existing theories: Two-factor model with superordinate factor	1 & 2 combined	3676.39*	103	.081	.889	.870	.177	Poor or unacceptable
Engaged Living Scale: Additional Cross Validation Models								
Four-factor EFA model	Sample 1	232.6*	62	.022	.989	.978	.071	Good or acceptable CFI/TLI and RMSEA
Four-factor CFA model	Sample 2	807.5*	98	.046	.960	.951	.115	Acceptable CFI/TLI, Poor or unacceptable RMSEA
Four-factor CFA model with residual correlations	Sample 2	416.5*	92	.033	.982	.976	.080	Good or acceptable CFI and RMSEA
Acceptance and Action Questionnaire-II: CFA Models								
Null hypothesis with a @0 correlation	1 & 2 combined	21,608.2*	21	.370	.000	.000	.966	Poor or unacceptable
The general single factor model	1 & 2 combined	900.3*	14	.038	.959	.938	.240	Acceptable CFI, Poor or unacceptable RMSEA
Acceptance and Action Questionnaire-II: Additional Cross Validation Models								
Three-factor EFA model	Sample 1	6.0*	3	.006	1.000	.998	.043	Excellent CFI and RMSEA
Three-factor CFA model (with one superordinate factor)	Sample 2	180.6*	12	.023	.983	.971	.160	Acceptable CFI, Poor or unacceptable RMSEA
One-factor CFA model with residual correlations among items	Sample 2	22.0*	11	.008	.999	.998	.043	Excellent CFI and good RMSEA

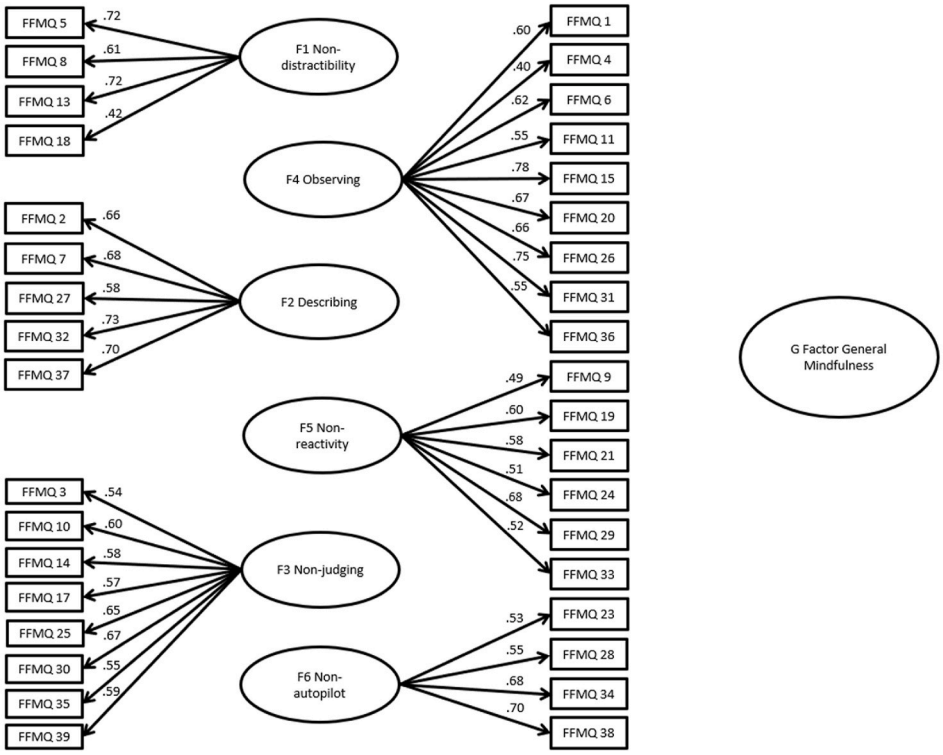
Note. * = $p < .05$; χ^2 = Chi-square test statistic; *df* = degrees of freedom; SRMR = standardized root mean square residual; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation.

values. The second factor was defined by three items (i.e., Items 4, 6, and 7) assessing the extent to which respondents are clear about their life directions, and we labeled this factor *clarity in life direction*. The third factor consisted of seven items (i.e., Items 10–16) that highlight the extent to which one has fulfilling life, and we labeled this factor *life fulfillment*. Finally, the fourth factor was derived from two items (i.e., Items 8 and 9) that measure the extent to which one's action is consistent with their own personal values, and we termed it *value-action congruence*.

Subsequently, a CFA was conducted with Sample 2 to confirm the factor structure of the base model. This four-factor CFA did not fit the data well ($\chi^2 = 807.46$, $df = 98$, $p < .0001$; RMSEA = 0.12, CFI = 0.96). Modification indices were consulted, and residual correlations among ELS items within individual factors (with the exception of a correlation between Items 5 & 2 within Factors 1 and 4, respectively, since Item 5 demonstrated a slight tendency to cross-load on Factors 1 and 4) were added as model constraints (see Fig. 2). The four-factor model with residual correlations was then tested again using CFA on Sample 2 and demonstrated acceptable fit to the data ($\chi^2 = 416.5$, $df = 92$, $p < .0001$; RMSEA = 0.08, CFI = 0.98). Thus, the four-factor structure of the ELS with residual correlations was selected as the best-fitting model and utilized for all subsequent analyses Table 3.

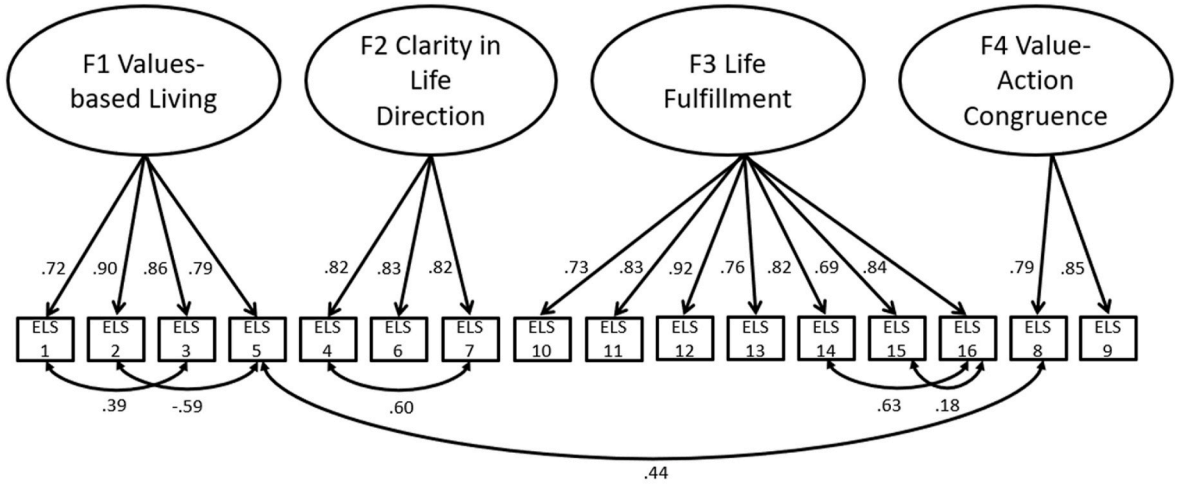
6.3. AAQ-II structural psychometric models

Based on previous research suggesting a unidimensional AAQ-II factor structure (e.g., Bond et al., 2011), a CFA was conducted with the entire sample to determine model fit indices for a one-factor model. Due to poor model fit for the null hypothesis and one-factor CFA model (see Table 2), EFAs were conducted on Sample 1. Based on goodness-of-fit statistics and meaningfulness of factors, a three-factor model retaining all seven original items was selected as our base model ($\chi^2 = 5.99$, $df = 3$, $p = .11$; RMSEA = 0.04, CFI = 1.00). The first factor was defined by one item (i.e., Item 3) that assesses the extent to which respondents are unable to control their anxiety and affective experiences, and we labeled this factor *uncontrollable worries*. The second factor was reflected in four items (i.e., Items 2, 5, 6, and 7) that capture the extent to which respondents perceive themselves to be entangled with their own worries and difficult feelings. We termed this factor *entangled with worries*. Finally, the third factor was defined by two items (i.e., Items 1 and 4) that assess the extent to which respondents perceive that their lives have been interrupted by their painful experiences in the



Note. $\chi^2 = 1{,}729.3$, $df = 648$, $p < .001$; RMSEA = .055, CFI = 0.95. FFMQ: Five Facet Mindfulness Questionnaire. Rectangles represent manifest variables. Oval shapes represent latent variables. Unidirectional arrows represent items loading on a given latent variable. For clarity of presentation, pathways between the G factor and manifest and latent variables are not shown.

Fig. 1. Final CFA of Five Facet Mindfulness Questionnaire (FFMQ).



Note. $\chi^2 = 416.5$, $df = 92$, $p < .001$; RMSEA = .080, CFI = 0.98. ELS: Engaged Living Scale. Rectangles represent manifest variables. Oval shapes represent latent variables. Unidirectional arrows represent items loading on a given latent variable. Double arrows represent residual correlations among items.

Fig. 2. Final CFA of Engaged Living Scale (ELS).

past or painful memories, and we labeled it *life interrupted*.

The three-factor base model was then tested using CFA with Sample 2 but did not demonstrate a good fit to the data ($\chi^2 = 180.64$, $df = 12$, $p < .001$; RMSEA = 0.16, CFI = 0.98). Hence, modification indices were consulted, and we found that a unidimensional model fit would improve if residual correlations among items within factors from the 3-factor EFA base model were added as model constraints. Subsequently, a CFA was conducted with Sample 2 again, specifying a unidimensional factor structure with additional constraints of residual correlations among AAQ-II items within factors of the original base model (with the exception of a correlation between Items 2 and 3 within Factors 1 and 2, respectively, as both items appear to be conceptually similar; see Fig. 3). This model fit the data well ($\chi^2 = 22.0$, $df = 11$, $p = .02$; RMSEA = 0.04, CFI = 1.00). Hence, the unidimensional factor structure of the AAQ-II with residual correlations was selected as the best-fitting model and utilized for all subsequent analyses.

Table 3
Factor structure loadings of final confirmatory models.

Item No.	Five Facet Mindfulness Questionnaire Confirmatory Factor Analysis	Factor 1 Non-distractibility	Factor 2 Describing	Factor 3 Non-judging	Factor 4 Observing	Factor 5 Non-reactivity	Factor 6 Non-autopilot
1	When I'm walking, I deliberately notice the sensations of my body moving.				.601		
2	I'm good at finding words to describe my feelings.		.660				
3	I criticize myself for having irrational or inappropriate emotions.			.547			
4	I perceive my feelings and emotions without having to react to them.				.396		
5	When I do things, my mind wanders off and I'm easily distracted.	.715					
6	When I take a shower or bath, I stay alert to the sensations of water on my body.				.623		
7	I can easily put my beliefs, opinions, and expectations into words.		.676				
8	I don't pay attention to what I'm doing because I'm daydreaming, worrying, or otherwise distracted.	.606					
9	I watch my feelings without getting lost in them.					.485	
10	I tell myself I shouldn't be feeling the way I'm feeling.			.604			
11	I notice how foods and drinks affect my thoughts, bodily sensations, and emotions.				.554		
13	I am easily distracted.	.720					
14	I believe some of my thoughts are abnormal or bad and I shouldn't think that way.			.578			
15	I pay attention to sensations, such as the wind in my hair or sun on my face.				.780		
17	I make judgments about whether my thoughts are good or bad.			.573			
18	I find it difficult to stay focused on what's happening in the present.	.416					
19	When I have distressing thoughts or images, I "step back" and am aware of the thought or image without getting taken over by it.					.606	
20	I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing.				.672		
21	In difficult situations, I can pause without immediately reacting.					.584	
23	It seems I am "running on automatic" without much awareness of what I'm doing.						.530
24	When I have distressing thoughts or images, I feel calm soon after.					.505	
25	I tell myself that I shouldn't be thinking the way I'm thinking.			.651			
26	I notice the smells and aromas of things.				.661		
27	Even when I'm feeling terribly upset, I can find a way to put it into words.		.584				
28	I rush through activities without being really attentive to them.						.547
29	When I have distressing thoughts or images, I am able just to notice them without reacting.					.678	
30	I think some of my emotions are bad or inappropriate and I shouldn't feel them.			.671			
31	I notice visual elements in art or nature, such as colors, shapes, textures, or patterns of light and shadow.				.757		
32	My natural tendency is to put my experiences into words.		.731				
33	When I have distressing thoughts or images, I just notice them and let them go.					.515	
34	I do jobs or tasks automatically without being aware of what I'm doing.						.684
35	When I have distressing thoughts or images, I judge myself as good or bad depending what the thought or image is about.			.550			
36	I pay attention to how my emotions affect my thoughts and behavior.				.547		
37	I can usually describe how I feel at the moment in considerable detail.		.700				
38	I find myself doing things without paying attention.						.703
39	I disapprove of myself when I have irrational ideas.			.589			

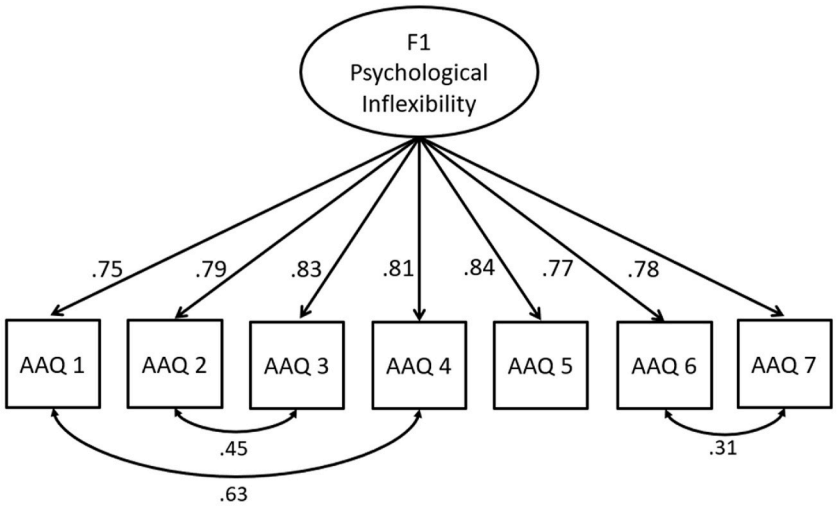
Item No.	Engaged Living Scale Confirmatory Factor Analysis	Factor 1 Values-based Living	Factor 2 Clarity in Life Direction	Factor 3 Life Fulfillment	Factor 4 Value-Action Congruence
1	I have values that give my life more meaning.	.718			
2	I know what motivates me in life.	.899			
3	I believe that I've found important values to live according to.	.859			
4	I know exactly what I want to do with my life.		.816		
5	I make choices based on my values, even if it is stressful.	.788			
6	I know how I want to live my life.		.832		
7	I know what I want to do with my life.		.817		
8	I believe that my values are really reflected in my action (behavior).				.798
9	I believe that how I behave fits in with my personal wants and desires.				.853
10	My emotions don't hold me back from doing what's important to me.			.725	
11	I live the way I always intended to live.			.825	
12	I am satisfied with how I live my life.			.916	
13	Nothing can stop me from doing something that's important to me.			.756	
14	I believe that I am living life to the full right now.			.821	
15	I make time for things I consider important.			.691	
16	I feel that I am living a full life.			.841	

Item No.	Acceptance and Action Questionnaire-II Confirmatory Factor Analysis	Factor 1 Psychological Inflexibility
1	My painful experiences and memories make it difficult for me to live a life that I would value.	.752

(*continued on next page*)

Table 3 (*continued*)

Item No.	Acceptance and Action Questionnaire-II Confirmatory Factor Analysis	Factor 1 Psychological Inflexibility
2	I'm afraid of my feelings.	.792
3	I worry about not being able to control my worries and feelings.	.831
4	My painful memories prevent me from having a fulfilling life.	.805
5	Emotions cause problems in my life.	.839
6	It seems like most people are handling their lives better than I am.	.769
7	Worries get in the way of my success.	.777



Note. $\chi^2 = 22.0$, $df = 11$, $p = .02$; RMSEA = .043, CFI = 0.99. AAQ: Acceptance and Action Questionnaire-II. Rectangles represent manifest variables. Oval shapes represent latent variables. Unidirectional arrows represent items loading on a given latent variable. Double arrows represent residual correlations among items.

Fig. 3. Final CFA of Acceptance and Action Questionnaire-II (AAQ-II).

6.4. Measurement invariance models

FFMQ. When the factor structure and corresponding items of the best-fitting model of the FFMQ was constrained (i.e., held constant) across ethnic and gender groups, respectively, a configural measurement invariance model demonstrated good fit to the data for both ethnicity ($\chi^2 = 3732.8$, $df = 1{,}831$, $p < .0001$; RMSEA = 0.05, CFI = 0.95) and gender ($\chi^2 = 2553.4$, $df = 1{,}115$, $p < .0001$; RMSEA = 0.05, CFI = 0.93) models. Subsequently, metric invariance models were run with an additional constraint of factor loadings being specified as equal across groups, and these models demonstrated similarly good fit to the data for ethnicity and gender analyses, respectively. Then, scalar invariance models were run, with the constraint of equal item intercepts across groups being added; these models also demonstrated adequate fit to the data for ethnicity and gender analyses, respectively. Lastly, strict invariance models were run, which add a constraint across groups of equal variance of unique factors (i.e., variance of test item residuals are equated across groups). In the case of strict invariance, both models for ethnicity and gender groups revealed a good fit to the data.

ELS. When the factor structure and corresponding items of the best-fitting model of the ELS was constrained across ethnic and gender groups, respectively, a configural measurement invariance model demonstrated adequate fit to the data for both ethnicity ($\chi^2 = 940.0$, $df = 279$, $p < .0001$; RMSEA = 0.08, CFI = 0.94) and gender ($\chi^2 = 813.2$, $df = 186$, $p < .0001$; RMSEA = 0.08, CFI = 0.94) models. Similar to the measurement invariance analyses for the FFMQ, metric, scalar, and strict invariance models were run for ethnicity and gender, respectively, for the ELS. All ELS measurement invariance models for both ethnicity and gender across the pertinent levels of invariance demonstrated adequate fit to the data, suggesting that measurement invariance was present for the ELS within ethnic and gender groups across varying levels of stringency in the present sample.

AAQ-II. When the factor structure and corresponding items of the best-fitting model of the AAQ-II was constrained across ethnic and gender groups, respectively, a configural measurement invariance model demonstrated excellent fit to the data for both ethnicity ($\chi^2 = 195.1$, $df = 103$, $p < .0001$; RMSEA = 0.05, CFI = 0.99) and gender ($\chi^2 = 194.3$, $df = 57$, $p < .0001$; RMSEA = 0.07, CFI = 0.99) models. Similar to the measurement invariance analyses for the FFMQ and ELS, metric, scalar, and strict invariance models were run for ethnicity and gender, respectively, for the AAQ-II. All AAQ-II measurement invariance models for both ethnicity and gender across the pertinent levels of invariance demonstrated adequate fit to the data, suggesting that measurement invariance was present for the AAQ-II within ethnic and gender groupings across varying levels of stringency in the present sample. Please see Table 4 for a complete listing of fit indices for all measurement invariance models across measures.

6.5. Reliability

Table 5 includes the internal consistency coefficients (i.e., reliability) for the FFMQ, ELS, and AAQ-II scales and subscales based on the final psychometric models specified above. The results indicated overall good reliability across all subscales of each of the three measures, with the reliability coefficients ranging from 0.75 to 0.91 for the FFMQ, 0.76 to 0.90 for the ELS, and 0.92 for the unidimensional AAQ-II.

6.6. Convergent and divergent validity

Table 5 also presents the inter-factor and inter-scale correlations for the FFMQ, ELS, and AAQ-II. Consistent with predictions, the overall pattern of findings generally supported convergent validity of all three

Table 4
Summary of measurement invariance analyses.

Model	χ^2	*df*	SRMR	CFI	TLI	RMSEA
Five Facet Mindfulness Questionnaire: Measurement Invariance Models						
Configural- ethnicity	3732.8*	1831	.047	.950	.948	.053
Configural- gender	2553.4*	1115	.047	.925	.915	.048
Metric- ethnicity	3493.5*	1701	.053	.953	.947	.054
Metric-gender	2579.0*	1118	.045	.923	.914	.049
Scalar- ethnicity	3586.4*	1975	.054	.957	.959	.047
Scalar- gender	3168.3*	1131	.098	.893	.881	.057
Strict- ethnicity	3818.6*	1995	.055	.952	.954	.050
Strict– gender	2677.6*	1188	.058	.922	.917	.048
Engaged Living Scale: Measurement Invariance Models						
Configural- ethnicity	940.0*	279	.213	.940	.922	.080
Configural- gender	813.2*	186	.202	.942	.925	.078
Metric- ethnicity	977.6*	309	.215	.939	.929	.077
Metric-gender	821.3*	201	.202	.943	.932	.075
Scalar- ethnicity	884.0*	325	.130	.949	.944	.068
Scalar- gender	702.7*	209	.127	.954	.948	.066
Strict- ethnicity	942.5*	357	.136	.947	.946	.067
Strict– gender	728.3*	225	.129	.954	.950	.064
Acceptance and Action Questionnaire-II: Measurement Invariance Models						
Configural- ethnicity	195.1*	103	.018	.996	.997	.049
Configural- gender	194.2*	57	.017	.994	.995	.066
Metric- ethnicity	62.1*	33	.009	.999	.997	.049
Metric-gender	52.9*	22	.008	.999	.997	.051
Scalar- ethnicity	133.2*	115	.016	.999	1.000	.021
Scalar- gender	84.4*	63	.014	.999	.999	.025
Strict- ethnicity	217.3*	127	.019	.996	.998	.044
Strict– gender	136.1*	69	.015	.997	.998	.042

Note. * = $p < .05$; χ^2 = Chi-square test statistic; df = degrees of freedom; SRMR = standardized root mean square residual; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation.

scales. The most robust evidence came from *inter-scale* correlations, in which aggregate FFMQ scores were positively correlated with aggregate ELS scores ($r = 0.48$) and negatively correlated with AAQ-II scores ($r = -0.59$). ELS scores were also negatively correlated with AAQ-II scores ($r = -0.48$). The moderate nature of these correlations suggest that these scales are measuring related, but distinct constructs of interest within the contextual CBT model of behavioral health and well-being (Hayes et al., 2011).

Evidence of convergent and divergent validity also was derived from *inter-factor* correlations among the six FFMQ factors, four ELS factors, and unidimensional AAQ-II. Here, also consistent with predictions, the ELS demonstrated the strongest evidence of convergent validity and divergent validity within relatively higher correlations *among* ELS factors (i.e., range = 0.44–0.61) and relatively lower correlations of ELS factors with the FFMQ factors (i.e., range = 0.06–0.39).

Contrary to predictions, evidence of convergent validity of the FFMQ was relatively less robust, in terms of notable variability within inter-factor correlations (i.e., $r = -0.20$ to 0.68). Specifically, the *observing, non-reactivity, and non-autopilot* factors demonstrated some negative or small correlations with other FFMQ factors. However, other FFMQ inter-factor correlations, especially among the *non-distractibility, describing, and non-judging* factors, were in the moderate range, suggesting some evidence of convergent validity within FFMQ factors. Finally, as presented briefly above, the AAQ-II unidimensional factor demonstrated evidence of convergent validity in terms of moderate negative correlations with ELS and FFMQ factors (i.e., range = −0.29 to 0.61; except for one outlier zero-order correlation between the AAQ-II and the FFMQ *observing* factor with $r = 0.09$).

7. Discussion

The present study sought to examine and psychometrically validate three commonly used contextual CBT-informed self-report measures with a sample of racially and ethnically diverse adults recruited from a

Table 5
Correlation matrix of Five Facet Mindfulness Questionnaire (FFMQ), Engaged Living Scale (ELS), and Acceptance and Action Questionnaire-II (AAQ-II).

	McDonald's Omega	Standardized Cronbach's Alpha	1	2	3	4	5	6	7	8	9	10	11	12	13
1) FFMQ F1 Non-distractibility	.88	.88	1.00												
2) FFMQ F2 Describing	.87	.87	.20	1.00											
3) FFMQ F3 Non-judging	.91	.91	.47	.18	1.00										
4) FFMQ F4 Observing	.83	.82	-.20	.39	-.22	1.00									
5) FFMQ F5 Non-reactivity	.75	.75	.17	.36	.13	.36	1.00								
6) FFMQ F6 Non-autopilot	.88	.88	.68	.20	.48	-.12	.11	1.00							
7) FFMQ[a]	.82	.87	.71	.65	.62	.22	.54	.71	1.00						
8) ELS F1 Values-based Living	.84	.84	.21	.31	.19	.17	.23	.24	.38	1.00					
9) ELS F2 Clarity in Life Direction	.87	.85	.22	.24	.23	.09	.14	.23	.33	.61	1.00				
10) ELS F3 Life Fulfillment	.90	.90	.33	.30	.39	.06	.28	.30	.48	.60	.54	1.00			
11) ELS F4 Value-Action Congruence	N/A[d]	.76	.26	.27	.23	.12	.23	.25	.38	.61	.44	.61	1.00		
12) ELS[b]	.93	.93	.31	.34	.32	.13	.26	.31	.48	.84	.81	.84	.79	1.00	
13) AAQ-II[c] Psychological Inflexibility	.92	.92	-.49	-.26	-.61	.09	-.29	-.44	-.59	-.35	-.32	-.56	-.34	-.48	1.00

All inter-factor and inter-scale correlations were statistically significant at the $p < .05$ level.

[a] McDonald's omega and standardized Cronbach's alpha were based on the 39 items of the FFMQ. Correlations were based on the mean of the six factors of the FFMQ.

[b] McDonald's omega and standardized Cronbach's alpha were based on the 16 items of the ELS. Correlations were based on the mean of the two factors of the ELS.

[c] McDonald's omega and standardized Cronbach's alpha were based on the 7 items of the AAQ-II. Correlations were based on the mean of the one factor of the AAQ-II.

[d] McDonald's omega was not able to be calculated for ELS F4 Value-Action Congruence due to the JASP software's inability to calculate omega for a factor with only two items.

large public university in Hawai'i. Results indicated that the factor structures of scores of the FFMQ (six factors), ELS (four factors), and AAQ-II (unidimensional with residual correlations among items) in the present sample differ slightly from those found in extant psychometric development research (e.g., Baer et al., 2008; Bond et al., 2011; Trompetter et al., 2013). However, correlations between and among these measures and conceptual interpretation of individual factors within these measures appear to comport with underlying contextual CBT models of health and behavior change (Hayes et al., 2011; Hayes & Hofmann, 2018). Additionally, measurement invariance analyses suggest that the FFMQ, ELS, and AAQ-II appear to be equivalently measuring purported constructs across diverse racial and ethnic groups in the present study. Furthermore, the inter-factor and inter-scale correlations generally supported the validity of the three scales. We present below a detailed interpretation of the present findings for each contextual CBT-informed measure.

7.1. FFMQ psychometric findings

Consistent with extant findings (e.g., Baer et al., 2006), our results suggest that mindfulness, as measured by the FFMQ, is best represented as a multidimensional construct within the present sample. More specifically, our structural model appears to generally comport with the findings of the original FFMQ psychometric development work with non-meditating samples (i.e., Baer et al., 2006; Baer et al., 2008), which was subsequently replicated by others (Christopher et al., 2012; Williams et al., 2014). Four of the original factors with the exact same items (i.e., *observing, describing, non-reactivity, non-judging*) are retained in our six-factor model, with the exception of the *describing* subscale in which items 12, 16, and 22 were dropped due to low factor loadings. Furthermore, in the present study, the original *acting with awareness* facet is further divided into *non-distractibility* and *non-autopilot* facets. Examination of the items within these factors suggests that the *non-autopilot* facet represents the behavioral aspects of ongoing awareness of experience (e.g., *running, moving*, or *acting* with conscious or deliberate thought), while *non-distractibility* reflects the cognitive ability of intentionally staying present (Brown & Ryan, 2003). Given the inclusion of a general factor correlating with each of the six factors as well as a robust correlation ($r = 0.68$) between these two emerging facets, we conclude that this variation from the original factor structure may not be markedly significant neither structurally nor conceptually (Floyd & Widaman, 1995; Haynes et al., 2019). Finally, results from inter-factor correlations within the FFMQ and inter-scale correlations also appear to support the convergent validity of the emerging facets of the FFMQ, which are comparable to those of previous non-meditating samples (e.g., Baer et al., 2008).

7.2. ELS psychometric findings

The factor structure of the ELS scores in the present sample differed slightly from models found in previous studies (i.e., two-factor model; Trompetter et al., 2013). That is, with the present sample of racially and ethnically diverse adults in Hawai'i, our findings suggest that being aware of one's values (*recognizing values*), having a clear life direction (*clarity in life direction*), having consistency between values and actions (*value-action congruence*), and having a fulfilling life (*life fulfillment*) are four related, yet unique, aspects of engaged living. However, once again, this variation in ELS factor structure found in the present study may not be markedly significant on a conceptual level (Floyd & Widaman, 1995; Haynes et al., 2019). Specifically, our findings simply suggest that the *valued living* factor found in Trompetter et al. (2013) can be further divided into three facets, while retaining the *life fulfillment* subscale almost exactly as was found in Trompetter et al. Furthermore, a good degree of conceptual overlap among the three emerging factors within the original *valued living* factor are confirmed by their higher inter-factor correlations ($r = 0.54$–0.61).

Finally, results from inter-factor and inter-scale correlations support the idea that ELS factors derived from the present study are theoretically related to, yet *distinct* from, facets of mindfulness and psychological inflexibility. This is especially the case for the scores of the *values-based living*, *clarity in life direction*, and *value-action congruence* facets. The scores of the *life fulfillment* factor, however, showed stronger associations with the scores of FFMQ factors ($r = 0.30$–0.39, with the exception of an $r = 0.06$ with the FFMQ *observing* factor) and the AAQ-II ($r = -0.56$), which may suggest its greater conceptual overlap with the constructs of mindfulness and psychological inflexibility.

7.3. AAQ-II psychometric findings

Findings concerning the AAQ-II were somewhat more nebulous compared to those of the FFMQ and ELS. This lack of clarity may reflect recent concerns regarding the psychometric properties of the AAQ-II more generally (Cherry et al., 2021; Tyndall et al., 2019; Wolgast, 2014). EFAs in the present study initially suggested a three-factor model as a good fit of the data. However, subsequent CFA validation did not support this model. We eventually chose a unidimensional model with theoretically consistent residual correlations between items within specific factors of the original three-factor model as the best fit of the data. This final factor structure is unidimensional, but different from that of previous studies (e.g., Bond et al., 2011; Fledderus et al., 2012) in that it seems to provide evidence pointing to psychological inflexibility measured by the AAQ-II as a multifaceted construct, which comports with psychological inflexibility discussed in contextual CBT literature (Doorley et al., 2020; Hayes et al., 2012)- a construct that may be related to, yet distinct from, psychological *flexibility* (i.e., psychological inflexibility and flexibility may lie on separate continuums; Rolffs et al., 2018).

7.4. Measurement invariance and the conditional nature of a Measure's psychometric characteristics

Both conceptually and empirically, our findings highlight the importance of remaining cognizant of the conditional nature of the psychometric evidence of a given measure (Haynes et al., 2018). As discussed elsewhere (Haynes et al., 2019), this entails that any psychometric evidence is dependent on the nature and context of the sample selected to gather that evidence. More specifically, while our findings are based on one sample collected at one point in time, we conclude that the factor structures of scores of the FFMQ, ELS, and AAQ-II in the present racially and ethnically diverse sample diverge slightly from the factor structures found in the original validation studies yet appear to remain conceptually consistent.

Aligned with the aim of the present study, previous research has examined whether the psychometric properties of contextual CBT-informed measures remain structurally and functionally invariant across diverse populations. For example, the FFMQ demonstrated configural, but not metric, invariance across cultures, with data collected from 16 different countries with different languages (Karl et al., 2020). Additionally, the AAQ-II demonstrated evidence of measurement invariance across different languages (Fledderus et al., 2012; Gloster et al., 2011; Ruiz et al., 2016) and ethnically diverse undergraduate students in the U.S. (Correa-Fernández et al., 2020; Edwards & Vowles, 2020). As discussed above, evidence for measurement invariance of the ELS is limited, as the psychometric development of this instrument it still in its infancy. In this research context, the present measurement invariance analyses across varying levels of constraints suggest that mindfulness, engaged living, and psychological inflexibility, as measured by the FFMQ, ELS, and AAQ-II, respectively, appear to be measured invariantly (i.e., in a similar fashion) across ethnic and gender groups in the present racially and ethnically diverse sample.

8. Limitations and future research

Findings from the present study require interpretation in light of several limitations. First, although the data for the invalid group were not included in the main analyses, these participants constituted a relatively significant percent (21.4%) of the initial sample. Second, despite disaggregating the sample by ethnicity (i.e., Asian, White, and All Others), heterogeneity remained even within these ethnic groups. Third, the present sample consisted mainly of emerging adults, and thus is not representative of other age groups in Hawai'i. Fourth, specific to the three scales, it remains unclear why our results yielded a six-factor structure of the FFMQ and four-factor structure of the ELS for the present sample. These differential findings could perhaps be due to theoretical concerns (i.e., mindfulness as an overarching construct with subfacets rather than five distinct factors; valued living measured by the ELS as one general construct or three distinct facets) or cultural factors (e.g., different conceptualizations of mindfulness in eastern and western cultural contexts; Masuda & Qina'au, 2022). Future studies should investigate the extent to which these differential factor structures are theoretically and clinically meaningful, and identify individual difference, contextual, and cultural factors that may explain these differential structures. Fifth, the present study utilized minor consultation of modification indices and incorporation of residual correlations in refining structural CFAs, which resulted in testing CFAs on Sample 2 twice. While multiple tests of a model on the same sample and over-reliance on modification indices can increase the risk of Type 1 errors and overfitting of CFAs (Sellbom & Tellegen, 2019), the process of refinement of CFA models used in the present study was theory-driven and conservative in nature. Finally, although the present study showed evidence of convergent validity in scores of the FFMQ, ELS, and AAQ-II, it did not allow us to carefully examine their divergent validity (e.g., whether scores of the AAQ-II reflect psychological inflexibility more so than distress and worry; see Wolgast, 2014). Future research should further investigate other types of validity within contextual CBT measures, including convergent-divergent validity with other scales, concurrent validity, predictive validity, and other forms of construct validity.

9. Conclusion

Despite the aforementioned limitations, the present examination contributes to the literature examining the psychometric properties of the FFMQ, ELS, and AAQ-II with a racially and ethnically diverse adult sample in Hawai'i. While differing slightly from previous studies, the factor structures of these measures presented in the current study remain consistent with extant theoretical frameworks (Hayes et al., 2011, 2012; Masuda & Rizvi, 2019). Furthermore, our findings offer preliminary insights into the optimal use of these measures with a specific population of interest (i.e., racially and ethnically diverse adults in Hawai'i). Specifically, interpreting scores of these measures based on the factor structures found in the present study may serve to maximize the utility and application of these measures in diverse contexts as recent research suggests that some of these constructs may have an interactive effect in explaining behavioral health outcomes (e.g., Jo et al., 2022).

Ethical statements

The present study was approved by the Institutional Review Board at the University of Hawai'i at Mānoa.

Informed consent

Given the online nature of the present study, all participants electronically *consented* to join the present study.

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Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Contributors

The first author led the literature review, discussed research questions with the sixth and seventh authors (senior author), ran data analyses, and wrote and revised the manuscript. The second author ran data analyses, and drafted, revised, and edited the manuscript. The third and fourth author ran data analyses, supervised the first and second authors in running data analyses, and reviewed/approved the final version of manuscript. The fifth author assisted in conducting a literature review and wrote/revised the manuscript. Finally, the sixth and seventh author (senior) supervised the first author, designed the study, collected the data, conducted the literature review, and wrote and revised the manuscript. The final manuscript was approved by all authors.

Declaration of competing interest

All authors declare no conflicts of interest. Dr. Akihiko Masuda serves on the editorial board of the Journal of Contextual Behavioral Science. Given Dr. Masuda's role as an editorial board member, he had no involvement in the peer-review of this article and had no access to information regarding its peer-review.

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