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RESEARCH PAPER

The Unity of Well-Being: An Inquiry into the Structure of Subjective Well-Being Using the Bifactor Model

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Abstract

In homage to the life and work of Ed Diener (1946–2021), the present study assessed the dimensions of the tripartite model (positive affect, negative affect, and life satisfaction) and two additional dimensions (domain satisfaction and happiness) to investigate the structure of subjective well-being using exploratory factor analysis and the bifactor model. Specifically, we tested whether these five dimensions belong to an essentially unidimensional subjective well-being construct. Towards this goal, we used a large, previously collected dataset closely matched to the U.S. census ($N = 2{,}000$, ages 18–65+; 52.4% female; 66.3% White; 14.9% Hispanic; 12% Black) and selected 24 items representing the five dimensions. Our results showed that all 24 items were internally consistent and highly correlated. Exploratory factor analyses revealed there were five underlying factors best characterizing the data. When fit to the bifactor model, a strong underlying general subjective well-being factor emerged. Additionally, general factor scores were highly reliable according to conventional reliability standards. A confirmatory factor analysis also supported the bifactor structure of subjective well-being. Overall, our findings suggest all 24 items from the five dimensions reflect one essentially unidimensional construct, which can be combined into a single subjective well-being score. Domain satisfaction and subjective happiness both belong to subjective well-being in the same way that the original three dimensions of life satisfaction, negative affect, and positive affect do.

Keywords Subjective well-being · Happiness · Positive affect · Negative affect · Life satisfaction · Domain satisfaction

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> "The creation of multi-item scales raises the important question about the structure of subjective well-being … Although many of the multi-item scales have shown promising results initially, they have yet to be adequately tested. Now that a number of scales are available, psychometric testing and refinement are critical." – Ed Diener

Recent history has seen a dramatic shift in the type of questions psychologists ask. As early as the nineteenth century, psychologists investigated how to ameliorate suffering among pathological populations (Hilgard, 1987). In the past few decades, however, psychologists began to address a variety of questions related to the nature and structure of well-being, as well as how to promote it in "normal," healthy populations (Seligman & Csikszentmihalyi, 2000). At the core of this shift is a focus on the question of how psychological research can help people live what Ed Diener (2000) simply referred to as "the good life."

Addressing questions about the good life has prompted psychologists to pick up where philosophers left off. However, there is a great diversity of opinion among philosophers on how to define the good life; From Aristotle's insistence on virtue to the detachment of Buddha, or even the utilitarian calculations of Bentham, few philosophers have agreed on how to define the good life (Cottingham & John, 1998; Wallace & Shapiro, 2006). Researchers inherited this confusing state of affairs and a multitude of well-being definitions and measures soon proliferated (Busseri & Sadava, 2011)—from hedonic to eudaimonic well-being, from flourishing to flow, not to mention global happiness, meaning in life, environmental mastery, mindfulness, and numerous others (Bradburn, 1969; Csikszentmihalyi, 1990; Deci & Ryan, 2008; Keyes, 2002; Lau et al., 2006; Ryff, 1989; Steger et al., 2006). Are each of these unique constructs, or do they reflect some larger construct of well-being? In other words, is well-being multidimensional or unidimensional?

1 Ed Diener and Subjective Well-Being

Among those who have studied the psychological principles behind the good life, few (if any) have contributed more to our overall understanding than Ed Diener and his colleagues. In his first contribution, Diener (1984), drawing on the literature of previous researchers such as Andrews and Withey (1974), addressed the problem of inconsistency in philosophers' accounts of the good life by taking the philosopher problem and flipping it on its head. Rather than asking questions about which philosopher was correct or weighing the relative merits of the different philosophies of the good life, Diener began with the assumption that evaluations of well-being would differ not only between philosophers but also between lay people.

Instead of trying to superimpose a philosophical framework on the good life, then, Diener (1984) suggested that well-being should be assessed using people's own subjective evaluations. Diener proposed that these evaluations could be divided into two components—a cognitive component and an affective component. The cognitive component, called *life satisfaction*, captured a person's beliefs about whether their life was good and rewarding. The affective (or emotional)

component captured a person's more transient emotions, which included both *positive affect* (the presence of pleasant emotions like "happiness" and "joy") and *negative affect* (the absence of unpleasant emotions like "sadness" and "anger"). Diener referred to these evaluations as *subjective well-being*, and this definition has been referred to as the tripartite model (Busseri & Sadava, 2011). Later, however, he built on this definition by adding another cognitive component, *domain satisfaction*, that evaluates a person's satisfaction in specific life domains like family, health, and work (Diener et al., 1999; Schimmack, 2008).

Subjective well-being has served as the focal point of scientific research addressing human happiness. Such research is predicated on two assumptions. The first is the democratic assumption that each person is capable of deciding for themselves what the good life means to them (Diener, 2000). The second is the scientific assumption that by studying aggregate self-reports we might learn about well-being directly, via empirical evidence, rather than by studying abstract philosophical arguments. Both assumptions have largely held true; it seems that peoples' subjective judgments of their own lives are a rich source of information, and researchers have learned a great deal by studying them in the years since Diener published his seminal article.

Beyond popularizing the construct, Diener and his colleagues have created many of the most commonly used measures of subjective well-being. These include the Satisfaction with Life Scale (Diener et al., 1985), the Affect Adjective Scale/Brief Emotion Report (Diener & Emmons, 1984), the Scale of Positive and Negative Experience (Diener et al., 2010), the Flourishing Scale (Diener et al., 2010), and the Comprehensive Inventory of Thriving (Su et al., 2014).

Diener was also keenly aware of the importance of moving the study of subjective well-being beyond the individual level to assessing it at the national level (Diener, 2000; Helliwell, 2003; Helliwell & Barrington-Leigh, 2010). At the individual level, scientific research often assumes a prescriptive role; researchers use empirical principles to inform plans of action that may improve peoples' quality of life in diverse domains such as academia, business, and medicine. However, at the national level, governments routinely attempt to examine the welfare of their citizens by using indirect economic indicators (e.g., gross domestic product, inflation, unemployment)—likely because such economic indicators are easier to measure than psychological constructs (Diener & Seligman, 2004). Diener called for the creation of a national well-being index, arguing that measuring subjective well-being at the national level could improve people's lives (Diener, 2000). Indeed, a national index would enable governments and organizations to directly assess the well-being of their citizens and make important policy decisions accordingly.

By all accounts, Diener's push for assessing subjective well-being at the national level has been a resounding success. More than 40 nations currently assess the well-being of their citizens in one form or another, the United Nations-sponsored World Happiness Report evaluating the happiness of 146 nations is now in its 10th year, and studies of subjective well-being have informed national initiatives such as the UK's policies directed at increasing access to mental health care (Diener et al., 2018; Helliwell et al., 2022; Layard & Clark, 2015). Yet the measures commonly used for such initiatives (e.g., a single global happiness item) could be improved by better understanding the structure of subjective well-being.

2 The Structure of Subjective Well-Being

At the core of much of Diener's research is a concern with the conceptual shape and position of subjective well-being. What are its components? How are they arranged? Should its components be treated as individual constructs, or studied in aggregate? How does subjective well-being fit in with other constructs and indicators to contribute a more comprehensive understanding of the good life? Many of these important questions have not been conclusively answered, and the lack of answers contributes to conceptual ambiguity in collective understanding. At present there are two broad challenges in the literature that need to be addressed.

The first challenge is that even after forty years of research the internal structure of subjective well-being remains ambiguous (Busseri & Sadava, 2011). It is widely accepted that subjective well-being is a multidimensional construct, but the questions of what dimensions comprise it and how the dimensions should be treated still have not been sufficiently addressed. The second challenge is that in the wake of this ambiguity a variety of measures have proliferated freely. The World Database of Happiness (Veenhoven, n.d.) maintains a comprehensive list of measures of happiness; as of 2022 there are over 1,400 of them, close to three hundred of which are multi-question scales that, themselves, can be evaluated for their dimensional properties. This creates an additional layer of interpretive confusion in the field, as researchers cannot tell whether (or how much) their findings have been distorted by how they chose to operationalize subjective well-being.

Both challenges can be addressed by resolving the question of the internal structure of subjective well-being. Clarifying the structure would allow for the creation of a "gold standard" subjective well-being measure that could be used at both the individual and national levels, as well as provide a conceptual comparison point for the evaluation of the numerous measures that currently exist. As such, the current state of well-being science is somewhat akin to the state of personality science prior to the discovery of the five-factor model (Digman, 1990; Goldberg, 1993). While the emergence of the five-factor model did not resolve all questions about the structure of personality, it transformed the scientific discussion from one about competing measures to one about the particulars of an agreed-upon structure. A similar transformation for well-being is long overdue.

Accordingly, we suggest that it would be beneficial for researchers to settle the question of the internal structure of subjective well-being. One reason that this has not happened yet, we are convinced, is because the field has historically lacked access to useful tools for analyzing the relationship between subjective well-being and its subscales. This situation has changed with the rediscovery of the bifactor model (Reise, 2012; Rodriguez et al., 2016b), which allows for a detailed partitioning of the variance in a measure so that researchers can separate the individual contributions of each measure from the common factor. The present research undertakes this challenge.

2.1 The Need for the Bifactor Model

The multidimensional nature of subjective well-being is not controversial. Ever since Diener (1984) popularized the tripartite model, researchers have treated subjective

well-being as a construct consisting of multiple components. A few key questions about the nature and number of those components, however, remain open.

2.1.1 What Sub-Dimensions Should Be Included?

Much of the research on subjective well-being relies on the tripartite model of subjective well-being originally proposed by Diener (1984). In reality, the number of factors is up for debate, and there is great inconsistency in how researchers treat the factors of subjective well-being and whether they address them individually or separately. Pavot and colleagues (Pavot et al., 2018) noted that subjective well-being can be conceived of as having two, three, or four factors, depending on the researcher's desire for specificity. Diener himself struggled with the question of whether life satisfaction—originally thought to be a single factor in the tripartite model, and the only one representing the cognitive component of subjective well-being—should be further partitioned into global and domain-specific components, ultimately concluding that domain-specific satisfaction (e.g., with work, health, family) should also be included (Diener et al., 1999; Schimmack, 2008). There are also some questions about constructs that overlap strongly with subjective well-being. Schimmack (2003), for example, noted that some scales assessing positive affect, such as the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988), omitted items assessing "happiness," which is surprising because happiness is the quintessential positive emotion and a stronger predictor of life satisfaction than other positive emotions. PANAS is also limited because it contains only high arousal affect items (e.g., "excited," "hostile"), while ignoring other lower arousal items (e.g., "calm," "bored"; McManus et al., 2019), which may lead to biased or erroneous conclusions (Pressman & Bowlin, 2014).

2.1.2 Can the Sub-Dimensions Be Aggregated?

Busseri and Sadava (2011) have done an admirable review of this controversy. Researchers often treat the sub-components of subjective well-being as if they are conceptually distinct from each other, despite high intercorrelations between the components that suggest they may reflect a single latent variable. Resolving this question is important; as Busseri and Sadava (2011) have pointed out, one possible conceptual configuration of the components of subjective well-being is that they are separate constructs that should not be aggregated—if that is the case, then subjective well-being might better be thought of as a broad label for the field that studies these separate components, rather than as the overarching variable that connects them.

2.1.3 What Is the Nature of the Higher-Order Construct?

Although the sub-components of subjective well-being have often been assessed separately in empirical literature, many researchers aggregate them into a latent higher order construct (Busseri & Sadava, 2011). Yet practices vary. Many researchers

merely assess life satisfaction using a single item (e.g., Lucas & Donnellan, 2012); some assess a few separate dimensions with multiple items (e.g., life satisfaction and positive affect), but analyze them separately (e.g., Ko et al., 2021); and others combine the dimensions into one composite score that includes all three sub-components (e.g., Medvedev & Landhuis, 2018). However, a growing body of research suggests that subjective well-being should be conceptualized as a multidimensional model with a single superordinate subjective well-being dimension (see Busseri, 2018; Busseri & Quoidbach, 2022; Metler & Busseri, 2017).

When researchers do treat subjective well-being as an aggregate construct, this is often accomplished by summing (or averaging) the raw or standardized scores of the individual components into a single score reflecting subjective well-being (e.g., Medvedev & Landhuis, 2018). However, without further information on the internal structure of subjective well-being it is not known whether the resulting score is an appropriate representation of a single higher-order latent variable representing subjective well-being, or if it is better thought of as a composite score that incorporates large amounts of unique information from each of the individual subscales that is unrelated to the latent factor (Busseri & Sadava, 2011).

An unanswered question remains about how the measures' item variance is partitioned between the subscales and the higher-order latent variable. Reise (2012) argued that once the multidimensionality of a construct has been established, the bifactor model should be used to determine how the variance is partitioned. Rodriguez and colleagues (Rodriguez et al., 2016a, b) introduced a series of statistical indices that, when used in conjunction with the bifactor model, show in many multidimensional measures the general factor accounts for a large proportion of the total variance and that unit-weighted total scores are highly reliable. Further, once partitioning out variance attributable to the general factor, subscale total scores have very poor reliability. These findings draw into question whether it is even useful to interpret findings from analyses that focus on individual subscales, as they appear to add little information over and above the general underlying factor or construct. Is this also the case for subjective well-being? The answer to this question has wide-ranging implications for how the construct should be treated.

3 The Bifactor Model

The bifactor model has a long history in the social sciences, having originally been proposed by Holzinger and Swineford (1937) and further developed by Schmid and Leiman (1957). For a review of the history, see Reise (2012). In recent years it has seen a resurgence thanks to the work of researchers such as Reise (2012) and Rodriguez and colleagues (Rodriguez et al., 2016b), because its basic structure and theoretical assumptions make it ideally suited for addressing problems of multidimensionality.

The bifactor model starts with the assumption that each item in a multidimensional measure loads on two separate factors. The first is a general factor representing the primary construct of interest. The second is a "grouping" factor that ties

clusters of similar items (e.g., "joy" and "fun") together. The grouping factors are assumed to be orthogonal to each other, while the general factor explains what is common and shared across all items (Rodriguez et al., 2016b). This is distinct from other hierarchical models, which treat the highest-order construct as representing the factor loadings from the sub-dimensions, but in no way attempt to partition variance into that which is common to all items versus smaller subsets forming sub-domains.

In the context of multidimensional measures, this effectively means that, unlike other hierarchical models which do not partition item variance the same way, it is possible to use a bifactor model to partition the common variance among items into variance attributed to the general factor and variance attributed to the individual subscales or group sub-domains. When most of the explained variance among the items is attributable to the general factor, a measure can be said to be "essentially unidimensional," which means that the unit-weighted total score of the measure can be used as a reliable representation of the latent construct that the measure was created to assess. Further, in a measure that is essentially unidimensional, computing subscale scores may be only of limited use, as the individual subscales may account for little variance above and beyond that accounted for by the general factor (Rodriguez et al., 2016b).

Establishing unidimensionality is useful for a couple reasons. First, it addresses the long-standing question in the field of whether the individual components of subjective well-being must (or even can) be studied separately or if it is more appropriate to aggregate them into a single measure of subjective well-being, thus simplifying the analyses required to conduct research on well-being. A second benefit relates to the development of future measures; some of the most powerful modern psychometric approaches to constructing measures such as unidimensional item response theory (IRT), require researchers to first establish that data are essentially unidimensional (Chen et al., 2006; Reise et al., 2014). Answering questions about whether measures of subjective well-being can be treated as essentially unidimensional, then, is also a key step towards the eventual development of measures that can be used as standards in the field.

4 Previous Subjective Well-Being Research Using the Bifactor Model

Of the various studies that have used the bifactor model to examine the structure of well-being, most do not use omega indices (e.g., Vittersø & Nilsen, 2002), nor do they give primary consideration to whether all the items constitute an essentially unidimensional scale (e.g., Lui & Fernando, 2018). Instead, one of their main focal points is the model fit of the bifactor model (e.g., Daniel-González et al., 2020; Lauriola & Iani, 2016). However, four prior papers are highly relevant to the present study. In the first article, Chen and colleagues (Chen et al., 2013) sampled American college students (Study 1) and adults in midlife (Study 2) to examine two prominent competing definitions of well-being: Diener's (1984) subjective well-being and Ryff's (1989) psychological well-being. Chen and colleagues (Chen et al., 2013) found that psychological well-being and subjective well-being were strongly related at the general construct level, but also distinct once their overlap with the general construct was partialled out. In the second article, Jovanović (2015) recruited

Serbian college students and found that the sub-dimensions of subjective well-being (positive affect, negative affect, and life satisfaction) could not be aggregated. In contrast, a third article by Longo and colleagues (Longo et al., 2016)—which sampled European adults and assessed emotional stability, positive emotion, vitality, and meaning (among other sub-dimensions)—found some preliminary support for a general well-being factor. In the fourth article, Al Nima and colleagues (Al Nima et al., 2020) recruited adults from Amazon Mturk and found that a bifactor model including positive affect, negative affect, life satisfaction, and harmony in life fit the data best.

These studies were conceptually well thought-out and scientifically useful. For example, Chen et al. (2013) and Al Nima et al. (2020) each added a potentially new sub-dimension to the larger subjective well-being construct (Ryff's psychological well-being and harmony in life, respectively). However, the four relevant articles also had some notable limitations. First, Al Nima and colleagues noted that the items in their new sub-dimension may need to be revised. Second, Chen et al. (2013) and Jovanović (2015) partially (or fully) relied on college student samples, which limit generalizability. Al Nima et al. (2020) sampled from Amazon Mturk, and past work finds 25–35% of Mturk data may be of dubious quality (Ahler et al., 2021). Mturk data quality issues include non-respondents (i.e., bots), duplicate completions from the same IP address, as well as careless, humorous, and/or insincere responses. Further, such issues appear to be "three to five times higher [on Mturk] than one would find on the least costly online survey panels (e.g., Dynata, Lucid)" (Ahler et al., 2021, p. 2). Additionally, three articles (Al Nima et al., 2020; Chen et al., 2013; Jovanović, 2015) used the PANAS (as discussed above) which is problematic because it assesses only high arousal affect items. Specifically, positive and negative affect tend to be independent and uncorrelated when assessed via the PANAS (Daniel-González et al., 2020; Schimmack, 2008). For example, Al Nima et al. (2020) may have found mixed results because the PANAS "contributed more to [its] respective specific latent factor than to the general latent [well-being] factor" (p. 20). Further, Longo and colleagues (Longo et al., 2016) did not assess life satisfaction, an important and highly cited sub-dimension of subjective well-being. Finally, Chen et al. (2013) was published before omega hierarchical indices became readily accessible and available.

5 The Present Study

Building on past research, our study has two goals. The first is to examine the dimensional structure of subjective well-being. The second is to test whether subjective well-being items representing the various dimensions are essentially unidimensional.

5.1 Aim 1: Examine the Dimensional Structure of Subjective Well-Being

About the only feature of the structure of subjective well-being that has escaped controversy is that it contains both a cognitive and an affective component. At times, these two components were thought to be adequately represented by assessing a

person's life satisfaction to capture the cognitive component, as well as measures of positive and negative affect to capture the affective component. This tripartite structure has been widely relied on in the literature and Jovanović (2015), as mentioned above, has even used the bifactor model to test it.

However, applying the bifactor model to the tripartite structure alone misses key developments in well-being science. Diener (1984) originally argued that life satisfaction was sufficient to capture the cognitive component of subjective well-being, but later added additional measures assessing satisfaction with specific life domains (Diener et al., 1999; Schimmack, 2008). Thus, as Pavot and colleagues (Pavot et al., 2018) noted, cognitive well-being can be partitioned into life satisfaction and domain satisfaction components.

Focusing on the tripartite model alone also misses an opportunity to resolve long-standing questions about alternative candidates for dimensions of subjective well-being. Chen et al. (2013) and Al Nima et al. (2020) added two potential new sub-dimensions, but there may be other unexplored sub-dimensions. Specifically, subjective happiness has long occupied a special (and well-cited) place in well-being science (Lyubomirsky & Lepper, 1999). Schimmack (2003) noted in his research on the relationship between subjective well-being and specific affect that mean levels of happiness showed a far stronger correlation with life satisfaction than mean levels of any other emotion measured, which indirectly suggests happiness should be included as an additional sub-dimension of well-being.

Accordingly, in the present study we use exploratory factor analysis to examine additional factors of subjective well-being. We hypothesized there would be five correlated dimensions, which include our two new dimensions (domain satisfaction and happiness) in addition to the original three subjective well-being dimensions (positive affect, negative affect, and life satisfaction).

5.2 Aim 2: Test Whether Subjective Well-Being is Essentially Unidimensional

Our second aim was to combine the items from the five scales to test whether they reliably form a single composite score reflecting subjective well-being. This was done using the bifactor model. The answer to this question is key to the present study for two reasons. First, if an examination of the bifactor indices suggests that the items can be combined then that would provide strong evidence whether there is a common, general construct underlying the five separate dimensions. This would provide some strong evidence in favor of including both domain satisfaction and happiness as subjective well-being factors. Second, examining the results of the bifactor model should provide evidence about whether–and to what degree–items from the five dimensions can be treated as essentially unidimensional. This is important because it addresses the question of whether the items from the five dimensions included in this study can be safely aggregated into a broader, multifaceted representation of subjective well-being. Overall, we hypothesize that all five dimensions will reflect one essentially unidimensional construct of subjective well-being with items that can be scored as one.

6 Methods

6.1 Participants

The present study is a cross-sectional analysis using data collected via Dynata for a prior study (see Study 2 of Kaufman et al., 2022). A nationally representative sample of participants were invited to participate in a 20-min online survey in exchange for cash compensation or its equivalent in rewards/discounts. In line with Diener's (2000) recommendation to use nationally representative samples, the study sample recruitment was based on a stratified approach designed to yield demographics approximating national distributions based on data from the 2010 U.S. Census (which was used to set distribution targets for age and gender) and the 2018 American Community Survey (which was used to set distribution targets for race and income). The demographic distribution of the sample, as well as its comparison to census targets, can be seen in Table 1. Almost all demographic parameters in the sample were within one percentage point of their corresponding national targets.

To ensure data integrity, five engagement checks were included randomly in the survey to verify that participants were paying attention to each item (e.g., "Please select 'Very True' here." In total, 3,699 participants completed all items on the survey (with no missing data). Participants who failed any engagement check were excluded. The 2,000 participants who passed every engagement check comprised the final sample used in the present analyses. All procedures for data collection were submitted to and received approval from the Institutional Review Board.

6.2 Measures

Measures were chosen with the intent to operationalize each of the four established dimensions of subjective well-being (life satisfaction, domain satisfaction, positive affect, negative affect) as well as the proposed dimension of happiness. In total, there were 24 items that were included in the present analyses. The text of all 24 items can be seen in Table 2.

The dataset used in the present study contained well-established and previously validated measures that could be used to operationalize three of the five dimensions. Life satisfaction was operationalized using the Satisfaction With Life Scale (SWLS; 5 items; Diener et al., 1985) rated from 1 = *Strongly disagree* to 7 = *Strongly agree*, domain satisfaction was operationalized using the Personal Well-Being Index (PWI; 8 items; The International Wellbeing Group, 2013) rated from 0 = *No satisfaction at all* to 10 = *Completely satisfied*, and happiness was operationalized using the Subjective Happiness Scale (SHS; 4 items; Lyubomirsky & Lepper, 1999) rated from 1 = *Less happy* to 7 = *More happy*.

There were no measures available in the dataset that specifically operationalized positive or negative affect, so measures had to be constructed using items from other scales. To assess positive affect, a total of three items were taken from the International Personality Item Pool Joyfulness Scale (IPIP; Goldberg, 2019) rated from 1 = *Very inaccurate* to 5 = *Very accurate*. Of the ten items on

Table 1 Sample demographics

	n	%	*Census (%)*
Age			
18–24	234	11.7	12.9
25–34	397	19.9	19.6
35–44	353	17.7	17.8
45–54	361	18.1	18.2
55–64	375	18.8	18.3
65 +	280	14.0	13.3
Gender			
Female	1020	51.0	51.0
Male	980	49.0	49.0
Race/Ethnicity			
Black	237	11.9	12.2
Asian	98	4.9	4.9
Hispanic	326	16.3	16.3
White	1283	64.2	63.8
Other	56	2.8	2.8
Annual Household Income			
< $30,000	340	17.0	16.5
$30,000—$49,999	300	15.0	14.8
$50,000—$74,999	346	17.3	16.8
$75,000—$99,999	298	14.9	14.5
$100,000—$149,999	354	17.7	17.9
> $150,000	362	18.1	19.7
Education			
> High School	33	1.7	–
High School	313	15.7	–
Some College	497	24.9	–
College Degree	757	37.9	–
Graduate Degree	395	19.8	–

$N = 2{,}000$

the original scale, the five items assessing positivity were retained. Of these, only three were kept; one ("love life") was removed because it indicated a global life evaluation and not a specific affect. A second ("just know that I will be a success") was removed because it indicated a cognitive evaluation. The remaining three items were used as an index of positive affect; the specific text of the items can be seen in Table 2. To operationalize negative affect, four items were taken from the neuroticism sub-scale of Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1975, 1984) rated 1 = *Yes* or 2 = *No*. The four items were selected specifically because they used the word "feel" to denote the tendency to experience certain types of negative affect. The specific text of the four chosen items can also be seen in Table 2.

Table 2 Means and item-rest correlations for the 24 subjective well-being items

Item #	Item content	*M*(*SD*)	Item-rest correlation
Life Satisfaction			
1	**LS-01**. In most ways my life is close to my ideal	6.9 (2.8)	0.80
2	**LS-02**. The conditions of my life are excellent	6.6 (2.6)	0.73
3	**LS-03**. I am satisfied with my life	6.6 (2.8)	0.86
4	**LS-04**. So far, I have gotten the important things I want in life	7.1 (2.7)	0.73
5	**LS-05**. If I could live my life over, I would change almost nothing	7.5 (2.4)	0.68
Domain Satisfaction			
6	**DS-01**. How satisfied are you with your standard of living?	6.2 (2.9)	0.73
7	**DS-02**. How satisfied are you with your health?	6.5 (2.9)	0.83
8	**DS-03**. How satisfied are you with what you are achieving in life?	7.3 (2.8)	0.59
9	**DS-04**. How satisfied are you with your personal relationships?	4.6 (1.8)	0.78
10	**DS-05**. How satisfied are you with how safe you feel?	4.8 (1.6)	0.77
11	**DS-06**. How satisfied are you with feeling part of your community?	5.1 (1.6)	0.82
12	**DS-07**. How satisfied are you with your future security?	5.1 (1.6)	0.71
13	**DS-08**. How satisfied are you with your spirituality or religion?	4.1 (1.9)	0.56
Happiness			
14	**H-01**. In general, I consider myself: (Not a very happy person ➔ A very happy person)	5.3 (1.4)	0.72
15	**H-02**. Compared to most of my peers, I consider myself: (Less happy ➔ More happy)	5.0 (1.5)	0.68
16	**H-03**. Some people are generally very happy. They enjoy life regardless of what is going on, getting the most out of everything. To what extent does this characterize you? (Not at all ➔ A great deal)	4.9 (1.6)	0.67
17	**H-04**. Some people are generally not very happy. Although they are not depressed, they never seem as happy as they might be. To what extent does this characterize you? (Not at all ➔ A great deal)	3.1 (1.9)	0.40
Positive Affect			
18	**PA-01**. Have a lot of fun	3.6 (1.0)	0.59

Table 2 (continued)

Item #	Item content	*M*(*SD*)	Item-rest correlation
19	**PA-03**. Radiate joy	3.2 (1.1)	0.55
20	**PA-04**. Feel lucky most of the time	3.3 (1.1)	0.55
Negative Affect			
21	**NA-02**. Do you ever feel "just miserable" for no reason?	0.7 (0.5)	0.45
22	**NA-06**. Do you often feel "fed up"?	0.6 (0.5)	0.48
23	**NA-15**. Do you often feel life is very dull?	0.7 (0.5)	0.53
24	**NA-20**. Do you often feel lonely?	0.7 (0.5)	0.51

Cronbach's alpha = 0.94. LS = Life Satisfaction (Satisfaction With Life Scale); *DS* = Domain Satisfaction (Personal Well-being Index); *H* = Happiness (Subjective Happiness Scale); *PA* = Positive Affect (International Personality Item Pool Joyfulness Scale); *NA* = Negative Affect (Eysenck Personality Questionnaire Neuroticism Subscale)

Each scale was assessed together in a single block, and the order in which the scales were presented to participants was: (1) PWI, (2) SWLS, (3) SHS, (4) IPIP Joyfulness, then (5) EPQ Neuroticism.

7 Analytic Plan

The analysis proceeded in three phases. In the first step, we computed simple descriptive statistics (means and standard deviations) for each of the 24 items. Additionally, we evaluated the correlation among all items, the item-rest correlations (which correct for item overlap with the total score) as well as the overall Cronbach's alpha value for the full pool of 24 items.

In the second step, we estimated a series of six exploratory factor models ranging from a simple one-factor solution up through a six-correlated-factors solution using minimum residuals with a promax rotation using the Psych package in R. Additionally, at this step, we also estimated a bifactor measurement model. The bifactor model allows for the calculations of several statistical indices which can be used to make judgments about whether a model can be treated as "essentially unidimensional" and whether it is adequate (or appropriate) to use the total score (or average score) of the measure as an estimate of the global construct that it measures (in this case, subjective well-being). In the present study, we derived multiple indices.

The first index, omega hierarchical (omegaH), estimates the proportion of the variance in total scores that is explained by the general factor. This value indicates the amount of variance of unit-weighted total scores that can be attributed to individual differences on the general factor (Reise, 2012; Rodriguez et al., 2016a, b). The logic of the omega hierarchical index can also be extended to the individual subscales after the general factor is controlled for; the resulting second index (omegaHS) indicates whether any unique variance remains in the subscale scores after correcting for the general factor. The omegaH and omegaHS indices are evaluated according to conventional research criteria (e.g. acceptable = 0.70-0.79, good = 0.80-0.89, excellent > 0.90). Additionally, we also calculated the explained common variance (ECV), which indexes the proportion of the total variance among the items (general + specific) that is explained by the general factor.

In the third and final step, we estimated a confirmatory factor model to evaluate the results from the exploratory models. The final model was evaluated using traditional fit indices such as the root mean square error of approximation (RMSEA $\leq$ 0.08), the comparative fit index (CFI $\geq$ 0.95) and the standardized root mean error of the residual (SRMR $\leq$ 0.08).

8 Results

8.1 Descriptive Statistics and Correlations

The descriptive statistics for each of the 24 items, as well as the inter-item correlations, can be seen in Tables 2 and 3, respectively. Cronbach's alpha for the 24 items

was excellent ($\alpha = 0.94$), with item-rest correlations ranging from $r = 0.40$ (H-04) to $r = 0.86$ (LS-03). All items were significantly correlated with one another ($p < 0.001$) with values ranging from $r = 0.20$ to $r = 0.82$. The average correlation between items was $r = 0.46$. As might be expected, items tended to exhibit stronger correlations within each scale (average $r = 0.59$) than between measures (average $r = 0.43$).

8.2 Exploratory Factor Analyses

Based on the anticipated theoretical structure containing five dimensions, we estimated six separate exploratory factor-analytic models (EFAs), starting with one factor and proceeding upwards to six factors. All models greater than one factor were correlated-factors models. The six-factor model was included for comparison purposes; to determine if adding an additional factor improved fit beyond the five-factor model. The model fit indices are presented in Table 4.

The results of the EFAs supported the five-correlated-factor model as the most suitable model to represent the data. In the one-factor model, factor loadings (λ) ranged from 0.45 to 0.86. In the two-correlated-factors model, the items partitioned into 13 cognitive items (life satisfaction and domain satisfaction; $\lambda = 0.43$ to 0.98) and 11 affect items (happiness, positive affect, negative affect; $\lambda = 0.49$ to 0.79), with a correlation of $r = 0.71$ between the two factors. In the three-correlated-factors model, items partitioned into 8 domain satisfaction items ($\lambda = 0.61$ to 0.86), 11 positivity items (happiness and positive affect; $\lambda = 0.52$ to 0.72) and five negative affect items ($\lambda = 0.52$ to 0.75) with factor correlations ranging from $r = 0.54$ to 0.72. In the four-correlated-factors model, items partitioned into 8 domain satisfaction items ($\lambda = 0.63$ to 0.86) and six positivity items ($\lambda = 0.51$ to 0.85), five life satisfaction items ($\lambda = 0.68$ to 0.88) and five negative affect items ($\lambda = 0.47$ to 0.80) with factor correlations ranging from $r = 0.57$ to 0.75.

The five-correlated-factors model partitioned items into eight domain satisfaction items ($\lambda = 0.63$ to 0.88), five life satisfaction items ($\lambda = 0.68$ to 0.88), five negative affect items ($\lambda = 0.43$ to 0.80), three positive affect items ($\lambda = 0.52$ to 0.81), and three happiness items ($\lambda = 0.54$ to 0.67) with factor correlations ranging from $r = 0.57$ to 0.75. RMSEA and SRMR were the lowest and TLI and percent of variance explained were the highest in the five-correlated-factors model, indicating the best fit. Also, from a theoretical perspective, the five-correlated-factors fit the data best because they corresponded to the five dimensions identified in previous literature. While the six-correlated-factors had slightly better fit indices, the six-factors model was overfit, with no items loading on the sixth factor. Thus, it was not appropriate to use. Overall, based on model fit indices and theory, the five-correlated-factors model best characterized the data and informed the specification of the bifactor model.

8.3 Bifactor Model and Confirmatory Factor Analysis

The factor loadings for both the bifactor model and the five-correlated-factors model (for comparison) are presented in Table 5. In the bifactor model, all items loaded strongly on the general factor ($\lambda = 0.46$ to 0.86, see Fig. 1) and five corresponding group

Table 3 Correlations among the 24 subjective well-being items

Variable	DS-01	DS-02	DS-03	DS-04	DS-05	DS-06	DS-07	DS-08	LS-01	LS-02	LS-03	LS-04	LS-05	H-01	H-02	H-03	H-04	PA-01	PA-03	PA-04	NA-02	NA-06	NA-15
DS-01	–																						
DS-02	.65	–																					
DS-03	.79	.68	–																				
DS-04	.62	.57	.67	–																			
DS-05	.63	.57	.63	.58	–																		
DS-06	.62	.60	.70	.60	.59	–																	
DS-07	.80	.67	.82	.62	.67	.65	–																
DS-08	.51	.48	.55	.50	.50	.53	.53	–															
LS-01	.63	.56	.67	.56	.48	.53	.65	.41	–														
LS-02	.69	.57	.66	.52	.52	.53	.67	.41	.78	–													
LS-03	.68	.58	.73	.60	.52	.55	.68	.47	.79	.77	–												
LS-04	.60	.48	.63	.53	.47	.49	.60	.39	.70	.67	.72	–											
LS-05	.42	.39	.48	.42	.32	.37	.44	.29	.62	.54	.58	.55	–										

Table 3 (continued)

Variable	DS-01	DS-02	DS-03	DS-04	DS-05	DS-06	DS-07	DS-08	LS-01	LS-02	LS-03	LS-04	LS-05	H-01	H-02	H-03	H-04	PA-01	PA-03	PA-04	NA-02	NA-06	NA-15
H-01	.52	.53	.61	.54	.45	.50	.56	.41	.60	.58	.67	.52	.46	–									
H-02	.48	.50	.57	.49	.39	.47	.53	.37	.56	.54	.62	.49	.42	.82	–								
H-03	.46	.50	.57	.46	.39	.49	.51	.38	.57	.54	.60	.49	.46	.80	.79	–							
H-04	.27	.26	.33	.27	.24	.23	.29	.23	.28	.30	.34	.29	.20	.46	.41	.43	–						
PA-01	.41	.43	.51	.48	.33	.44	.45	.34	.48	.47	.51	.42	.36	.58	.55	.58	.31	–					
PA-03	.35	.40	.46	.40	.31	.40	.43	.30	.44	.42	.44	.37	.36	.59	.58	.60	.30	.58	–				
PA-04	.41	.39	.47	.37	.31	.40	.46	.31	.48	.47	.47	.42	.37	.49	.49	.51	.26	.48	.50	–			
NA-02	.27	.33	.37	.27	.23	.30	.32	.23	.34	.34	.37	.31	.28	.49	.47	.47	.41	.32	.31	.30	–		
NA-06	.33	.34	.39	.32	.28	.34	.37	.26	.36	.36	.40	.32	.25	.48	.43	.45	.38	.33	.30	.27	.51	–	
NA-15	.36	.37	.44	.35	.28	.36	.40	.26	.40	.40	.45	.37	.29	.52	.49	.48	.40	.41	.34	.30	.54	.50	–
NA-20	.33	.36	.42	.39	.27	.36	.37	.23	.42	.39	.47	.37	.31	.50	.47	.48	.34	.36	.30	.28	.50	.44	.55

All correlations are statistically significant at $p < 0.05$. All negative affect items are reverse coded, as is one item from the Subjective Happiness Scale (H-04). *DS* = Domain Satisfaction; *LS* = Life Satisfaction; *H* = Happiness; *PA* = Positive Affect; *NA* = Negative Affect

Table 4 Model fit from exploratory factor analyses

Model	RMSEA	SRMR	TLI	% Variance explained
1-factor	.124	.08	.753	48%
2-correlated-factors	.091	.04	.867	54%
3-correlated-factors	.078	.03	.902	58%
4-correlated-factors	.052	.02	.956	61%
5-correlated-factors	.043	.01	.970	62%
6-correlated-factors	.035	.01	.980	63%

RMSEA = Root Mean Square Error of Approximation; *SRMR* = Standard Root Mean Squared Residual; *TLI* = Tucker-Lewis Index

factors (domain satisfaction: $\lambda = 0.41$ to 0.55; negative affect: $\lambda = 0.27$ to 0.53; life satisfaction: $\lambda = 0.41$ to 0.54; happiness: $\lambda = 0.32$ to 0.47; positive affect: $\lambda = 0.30$ to 0.36).

The omegaH value for the general factor scores was 0.83, meeting the omegaH threshold for acceptable reliability. After partitioning out general factor variance, reliability was extremely poor for the domain scores (omegaHS was 0.33 for domain satisfaction scores; 0.34 for negative affect; 0.27 for life satisfaction; 0.24 for happiness; and 0.13 for positive affect) implying very little meaningful variance was captured by the group factor scores. Lastly, ECV was 67%, indicating that over two-thirds of the common variance was explained by the general factor.

A confirmatory factor model representing the bifactor structure fit the data well: RMSEA = 0.057 (CI: 0.054 to 0.059); SRMR = 0.040; CFI = 0.958. Taken together, these results indicate that scores primarily reflect one underlying construct. Further, they indicate that once the general factor has been controlled for, very little unique variance remains in the group factors, as indicated by omegaHS for the subscale scores. This provides further support for the use of a single subjective well-being total score.

9 Discussion

How people feel about their lives—that is, the subjective evaluations they attach to the quality of their own existence—is arguably one of the most important constructs studied in psychology. Ed Diener and his colleagues initiated and expanded the study of this important construct, contributing immensely to our overall understanding of what makes human life worth living. Their foundational work has seeded a vast constellation of empirical studies. Indeed, at the time of this writing, a Google Scholar search of the term "well-being" returned over 5,000,000 results. Diener created and popularized key measures of well-being and extended them not only to the field of psychology but to the national level, persuading governments across the world (and even intergovernmental organizations like the United Nations) that they should assess people's happiness directly rather than relying on indirect economic indicators and/or philosophical theories (Diener et al., 2000).

Table 5 Exploratory factor analysis factor loadings for the five-correlated-factors model and the bifactor model

Item #	Five-correlated-factors model					Bifactor model					
	DS	LS	H	PA	NA	Gen	DS	LS	H	PA	NA
1	.79	–	–	–	–	.66	.49	–	–	–	–
2	.67	–	–	–	–	.63	.43	–	–	–	–
3	.74	–	–	–	–	.74	.47	–	–	–	–
4	.63	–	–	–	–	.63	.41	–	–	–	–
5	.88	–	–	–	–	.55	.55	–	–	–	–
6	.77	–	–	–	–	.61	.50	–	–	–	–
7	.79	–	–	–	–	.70	.50	–	–	–	–
8	.69	–	–	–	–	.49	.44	–	–	–	–
9	–	.88	–	–	–	.73	–	.54	–	–	–
10	–	.73	–	–	–	.71	–	.44	–	–	–
11	–	.70	–	–	–	.78	–	.41	–	–	–
12	–	.71	–	–	–	.65	–	.43	–	–	–
13	–	.68	–	–	–	.55	–	.42	–	–	–
14	–	–	.67	–	–	.86	–	–	.36	–	–
15	–	–	.64	–	–	.81	–	–	.35	–	–
16	–	–	.54	–	–	.81	–	–	.30	–	–
17	–	–	–	–	.43	.46	–	–	–	–	.27
18	–	–	–	.66	–	.61	–	–	–	.41	–
19	–	–	–	.81	–	.60	–	–	–	.47	–
20	–	–	–	.52	–	.55	–	–	–	.32	–
21	–	–	–	–	.80	.51	–	–	–	–	.53
22	–	–	–	–	.67	.50	–	–	–	–	.44
23	–	–	–	–	.78	.55	–	–	–	–	.53
24	–	–	–	–	.66	.53	–	–	–	–	.44

All values in this tables are factor loadings (λs). EFA models estimated using minimum residual extraction with a promax rotation. Cross-loading values (<.20) are denoted (-) for ease of interpretation. *Gen* = General factor (i.e., impact); *DS* = Domain Satisfaction; *LS* = Life Satisfaction; *H* = Happiness; *PA* = Positive Affect; *NA* = Negative Affect

Building on Diener's work, we used a large dataset closely matched to the U.S. census to understand the overall dimensional structure of subjective well-being by estimating a series of exploratory factor models and a bifactor measurement model. Towards this goal, we selected 24 items that represented five separate dimensions of well-being: positive affect, negative affect, life satisfaction, domain satisfaction, and happiness (Diener, 2009; Diener et al., 1999; Lyubomirsky & Lepper, 1999). This allowed us to determine whether these dimensions all tapped into something common and whether there was anything unique about them these after accounting for that which was common to all.

Our results showed that all 24 items were internally consistent and highly correlated. In line with our predictions, exploratory factor analyses revealed that there were five underlying factors best characterizing the data and subjective well-being. Further,

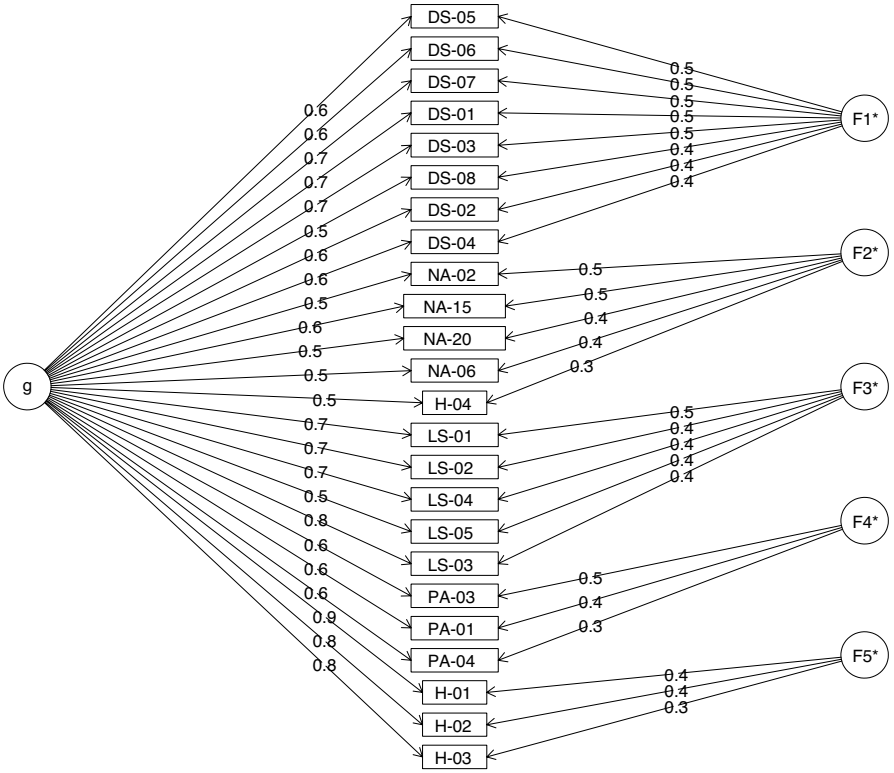

Fig. 1 Bifactor model of subjective well-being. Bifactor measurement model demonstrating one general factor (g) underlying all items and five group factors consisting of eight domain satisfaction items (F1), four negative affect items and one reverse-coded happiness item (F2), five life satisfaction items (F3), three positive affect items (F4), and three happiness items (F5). DS = Domain Satisfaction; NA = Negative Affect. LS = Life Satisfaction; PA = Positive Affect; H = Happiness

when fit to the bifactor model, a strong underlying general subjective well-being factor emerged accounting for two-thirds of the explained common variance. Additionally, general factor scores were highly reliable according to conventional standards. As a final step, confirmatory modeling also supported the bifactor structure of subjective well-being.

In other words, our findings suggest that positive affect, negative affect, life satisfaction, domain satisfaction, and happiness all reflect (or roll up into) one larger construct (and score) of subjective well-being. Thus, items representing each of these dimensions could and even should be administered together to better assess and understand people's well-being. It is especially noteworthy that both domain satisfaction (a component later added to the tripartite structure) and happiness (a different measure developed separately) both "belong" to subjective well-being in the same way that the original three dimensions of life satisfaction, negative affect, and positive affect do. This finding opens-up the question of whether there may be other dimensions (e.g., flourishing, meaning in life) that also belong to the construct.

Although our results are preliminary and need further replication, we believe they represent an important finding for well-being science. What are the implications for researchers? To better understand and measure subjective well-being, it is best to include items assessing all five dimensions, as each dimension reflects the heterogeneous breadth and depth of the construct. Indeed, each dimension taps into subjective well-being, but one (or two) dimensions alone do not solely represent subjective well-being. Each added dimension yields valuable information about a person's well-being.

Thus, we would advise against using only one dimension (e.g., positive affect), then speaking confidently about the broader construct of subjective well-being. Such an approach is likely flawed because it relies too much on the partial information provided by a single sub-factor. Indeed, the fact that these different sub-dimensions are used as proxies for subjective well-being may contribute to replication failures. For those researchers who want to generalize to well-being more confidently, aggregation of the five dimensions (e.g., using structural equation modeling) would potentially be better practice. However, we are not recommending against studying specific sub-dimensions separately if researchers are interested in narrower constructs (e.g., just positive affect). There is nothing wrong with such practice as long as researchers clearly define the construct of interest and do not generalize too broadly to subjective well-being.

By way of analogy, we would suggest that the easiest way to understand the relationship, and therefore our recommendations, is to consider the relationship between a well-known personality construct (such as neuroticism) and its facets (depression, anxiety, and emotional volatility; Soto & John, 2017). Each of these facets reflect the core construct. And each facet may be a worthwhile topic of study in its own right. However, researchers would be skeptical of someone who measured only depression and then decided to generalize their findings confidently to neuroticism. While the two overlap, studying depression alone would provide only partial information, leaving out valuable insights into neuroticism as a whole, as well as introducing potential biases.

9.1 Limitations

Although this study has many strengths, it also has some key limitations. First, the previously collected dataset we used did not contain well-validated measures of positive and negative affect. Given the findings of Jovanović (2015), who found that the tripartite subjective well-being structure (positive affect, negative affect, and life satisfaction) could not be aggregated, a skeptical reader may wonder if our affect items were poorly operationalized. However, we do not think this is the case. We carefully selected items that emphasized feeling states and excluded items that assessed more cognitive, global life evaluations. We also chose affect items that assessed both high (e.g., "fun") and low (e.g., "dull") arousal. Our exploratory factor analyses also suggested our items were indeed emotion-relevant, as they frequently loaded with happiness items. In other words, both the positive and negative affect items behaved largely as one would expect well-validated measures of each construct to behave. Other related challenges include that many of the available scales were on the short side (three to eight items) and there are numerous other constructs/measures (e.g., flourishing, optimism, meaning in life) not assessed in the dataset that may also belong to the construct of subjective well-being. Additionally, the order in which scales (and

items on scales) are presented may impact results (Schwarz et al., 1991). For example, participants' responses may change depending on whether the Satisfaction With Life Scale is presented before the Personal Well-Being Index (or vice versa); further, correlations among items within a single scale may differ when the items are presented in one block together or distributed over the test. Overall, the present data, while sufficient, are not optimal. As such we advocate for a guarded interpretation of our results until further analyses have replicated and extended them.

Finally, we used a large, representative dataset that recruited U.S. adults. Although this allowed us to assess the structure of subjective well-being on a national level, as Diener argued researchers should do (Diener, 2000), these data still come from an oversampled "WEIRD" (Western, Educated, Industrialized, Rich, and Democratic) nation (Henrich et al., 2010). As such, our results likely do not generalize to other nations, cultures, and contexts. Future research should determine whether the structure of subjective well-being varies by culture.

9.2 Future Directions

In terms of future directions, however, our primary recommendation is that researchers should hasten to develop a gold-standard measure of subjective well-being. The present study has answered an important initial question about whether it is possible to do so. Given that we found both domain satisfaction and happiness also belong to subjective well-being, this begs the question: what other dimensions also belong to the construct? See Longo et al. (2017) for an initial attempt to do this.

We suggest the next step should be a more comprehensive study that includes items from the five dimensions, as well as new items and items from other existing scales (e.g., flourishing, optimism, meaning in life). For example, given the findings of Chen et al. (2013), it would be interesting to determine whether Ryff's (1989) psychological well-being also belongs to the broader construct tested here.

A larger, follow-up study could assess whether other dimensions (if any) belong to the construct and create a more comprehensive measure of subjective well-being. After using the bifactor model to accomplish this goal, researchers could then use item response theory (IRT) to find optimal items. Such a measure may improve replication efforts, by providing researchers with a reliable and valid measure, as well as discourage use of miscellaneous, piecemeal, and partial measures that do not fully represent well-being. Such an initiative could also inform theoretical concerns (e.g., examining the differences between hedonic vs. eudaimonic well-being; Sheldon, 2018).

10 Conclusion

Most people want to be happy (Diener, 2000; Moore, 2016), but what is happiness? Lay people attach a variety of meanings and sources to it (e.g., love, health, faith, nature, success; Bojanowska & Zalewska, 2016). So do researchers, as evidenced by the multitude of measures used to assess various aspects of well-being and related

constructs (Busseri & Sadava, 2011). Given American values enshrining each person's right to pursue happiness (Jefferson, 1776), better definitions and measures of subjective well-being could further research that supports this aim—as well as make such work more useful, reliable, valid, and replicable. The present study takes an important step in this direction, showing that two additional dimensions (domain satisfaction and happiness) also belong to the tripartite model of subjective well-being (positive affect, negative affect, and life satisfaction). Together, these five dimensions form one essentially unidimensional subjective well-being construct. Overall, we hope our research has furthered the legacy of Ed Diener, whose tireless work on defining and measuring subjective well-being laid the foundation for a scientific understanding of human happiness.

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Declarations

Conflicts of Interest The authors have no known financial or non-financial conflicts of interest to disclose.

Informed Consent All procedures for data collection were submitted to and received approval from the Institutional Review Board, and participants provided informed consent. Data, materials, and code are available on request.

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