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## Measuring Multidimensional Subjective Well-Being with the I COPPE Scale in a Hispanic Sample

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### ABSTRACT

The purpose of this study was to provide initial validity evidence for measuring multidimensional subjective well-being in a Hispanic sample with the Interpersonal, Community, Occupational, Physical, Psychological, Economic (I COPPE) Scale. Participants were 641 English-speaking adults who self-identified as Hispanic. Bi-factor analyses were used to evaluate (a) the a priori measurement theory for responses to the I COPPE Scale and (b) convergent relationships of the seven I COPPE subjective well-being factors with scores from established comparison instruments. There was evidence that (a) the a priori hypothesized measurement theory for responses to the I COPPE Scale emerged in an exploratory bi-factor analysis and (b) the I COPPE subjective well-being factors exhibited convergent relationships with scores from comparison instruments. Use of the I COPPE Scale to derive multidimensional measures of subjective well-being may be of potential utility to future research in the interdisciplinary study of human movement and in a diversity of populations in which health disparities may exist.

### KEYWORDS

bi-factor; exploratory structural equation modeling; validity; wellness

“Subjective well-being represents people’s evaluations of their lives both in terms of cognitions (e.g., ‘My life is satisfying’) and feelings (e.g., ‘My experiences are pleasant and rewarding’)” (Diener, 2012, p. 590). The prominence of subjective well-being in the broad psychological literature has warranted periodic reviews of it in impactful, general psychology journals (e.g., Diener, 2012). Similarly, syntheses of the motivational determinants of subjective well-being within the psychology of human movement have begun to emerge (e.g., Adie & Bartholomew, 2013). Within each of the reviews mentioned above, however, conceptualization of the subjective well-being construct often is somewhat amorphous (e.g., operational definition, dimensionality, etc.), and the measurement of the construct often is inconsistent (e.g., instrument selected to measure the construct across studies). From this point forward, we generally omit the term “subjective” from the expression “subjective well-being” for textual parsimony.

The rationale for the development of the Interpersonal, Community, Occupational, Physical, Psychological, Economic (I COPPE) Scale (Prilleltensky et al., 2015) was based on the theory that well-being encompasses life satisfaction across various life domains (e.g., Prilleltensky &

Prilleltensky, 2006): interpersonal, community, occupational, physical, psychological, economic, and overall. The conceptual framework from which the I COPPE Scale was developed was based on a broad consensus that well-being entails satisfaction with life as a whole and with specific sub-domains of well-being (e.g., Chmiel, Brunner, Martin, & Schalke, 2012; E. H. Cohen, 1999; Pavot & Diener, 2008; Rath & Harter, 2010). Prilleltensky et al. (2015) attempted to integrate and synthesize disparate models, facets, and measures of subjective well-being into a single instrument, the I COPPE Scale, designed to measure individual perceptions of multidimensional well-being. Overall well-being was defined by Prilleltensky et al. (2015) as a positive state of affairs in one’s life. Interpersonal well-being was defined by Prilleltensky et al. (2015) as satisfaction with the quality of relationships with important people in one’s life (e.g., family, friends, etc.). Community well-being was defined by Prilleltensky et al. (2015) as satisfaction with the community where one lives. Occupational well-being was defined by Prilleltensky et al. (2015) as satisfaction with one’s main occupation (e.g., employed, self-employed, etc.). Physical well-being was defined by Prilleltensky et al. (2015) as satisfaction with one’s overall health and

wellness. Psychological well-being was defined by Prilleltensky et al. (2015) as satisfaction with one's emotional life. Economic well-being was defined by Prilleltensky et al. (2015) as satisfaction with one's financial situation.

Consistent with the inter-disciplinary nature of the study of human movement, there is evidence that each of the dimensions of well-being purportedly measured by the I COPPE Scale (except for economic)—interpersonal (e.g., O'Neil et al., 2010), community (e.g., Son, Yarnal, & Kerstetter, 2010), occupational (e.g., Cheon, Reeve, Yu, & Jang, 2014), physical (e.g., Van Hoecke, Delecluse, Bogaerts, & Boen, 2014), psychological (e.g., Alcaraz, Torregrosa, & Viladrich, 2015), and overall (e.g., Maher, Doerksen, Elavsky, & Conroy, 2014)—is relevant within the study of human movement. Within each of the cited studies in the previous sentence, however, a different approach (e.g., instrument) was used to measure the identified domain of well-being. O'Neil et al. (2010) measured interpersonal well-being with the social functioning subscale of the Pediatric Quality of Life Inventory (Varni, Seid, & Kurtin, 2001) in a sample where approximately one half of the participants identified as Hispanic. Son et al. (2010) measured community well-being by analyzing open-ended responses with qualitative methods in a sample where almost all of the participants identified as White. Cheon et al. (2014) measured occupational well-being in a Korean sample with the item: *in general, I am satisfied with my job* (Caprara, Barbaranelli, Borgogni, & Steca, 2003). Van Hoecke et al. (2014) measured physical well-being in a Flemish sample with the Louvain Well-being Scale (Marcoen, Van Cotthem, Billiet, & Beyers, 2002). Alcaraz et al. (2015) measured psychological well-being in a Spanish sample with five items from the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988) and five items from the Subjective Vitality Scale (SVS; Ryan & Frederick, 1997). Maher et al. (2014) measured overall well-being with an item, *I am satisfied with my life today*, from the Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffin, 1985) in a sample where most of the participants identified as White and non-Hispanic.

Future use of a single instrument, such as the I COPPE Scale, to derive multidimensional measures of well-being across related studies within human movement may enhance validity due to greater consistency in test selection (American Educational Research Association [AERA], American Psychological Association [APA], & National Council on Measurement in Education [NCME], 2014). Consistent with current standards for educational and psychological testing (AERA et al., 2014) the authors of

this study view validity as a unitary concept and attempt to provide types of validity evidence (e.g., evidence for relationships with conceptually related constructs should be provided for each of the population(s) for which an instrument is intended) versus providing evidence for distinct types of validity (e.g., “predictive” validity). Similarly, all subsequent references to validity evidence in this article are made with respect to responses to the I COPPE Scale and not the I COPPE Scale itself per se.

A standard for validity in testing that was relevant to the current study is that evidence should be provided for the population(s) for which an instrument is intended to be used (AERA et al., 2014). Hispanics are a (but not the only) population for which the I COPPE Scale is intended to be used but for which validity evidence does not yet exist. As compared to other ethnic groups, Hispanics often experience poorer physical outcomes in the United States (e.g., Ogden, Carroll, Kit, & Flegal, 2014). For example, Hispanics are disproportionately affected by not only overweight and obesity, but the majority of its associated major comorbidities, including type 2 diabetes and cardiovascular disease, relative to non-Hispanics. Hispanics in the United States show disproportionately higher rates of obesity with 77% of adult Hispanics overweight or obese compared to 68% of non-Hispanic Whites. Physical activity, too, is particularly inadequate among Hispanics and contributes to the disproportionate rates of obesity in this population. For example, compared to non-Hispanic Whites (22.8%), a smaller proportion of Hispanic adults (14.4%) meet the 2008 Physical Activity Guidelines for aerobic and muscle-strengthening activity (Centers for Disease Control, <http://www.cdc.gov/physicalactivity/data/facts.html>). There also is evidence that Hispanics in the United States have less access to treatment of behavioral and emotional disorders, which may have implications for psychological health (Fernández, Das, Alfonso, Weissman, & Olfson, 2005). Providing initial validity evidence for measuring multidimensional well-being in a Hispanic sample with the I COPPE Scale would not only be potentially important from a health disparities perspective, it would also adhere to some related recommendations for improving measurement practices in the theory-based study of human movement (Zhu, 2012a).

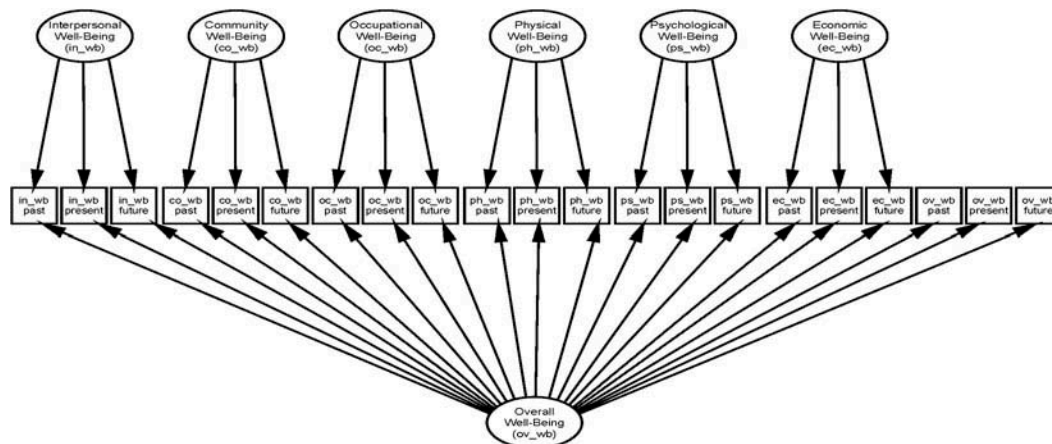
Theory-based scales in human movement often are developed to measure both a general continuous latent construct along with several more narrowly defined continuous latent subdomains (e.g., Myers, Martin, Ntoumanis, Celimli, & Bartholomew, 2014). The bifactor model (Holzinger & Swineford, 1937) has a general factor (e.g., overall well-being) and more specific group factors (e.g., interpersonal, community,

occupational, physical, psychological, economic well-being) and a pattern (or “loading”) matrix with a bi-factor structure in which each item loads on the general factor and also may load on a group factor. A general case for use of bi-factor analysis (and possible relationships to other parameterizations of the common factor model) in human movement is beyond the scope of the current article and has already been put forth (e.g., Myers et al., 2014; Reise, 2012) and related applications have begun to emerge (e.g., Appleton, Ntoumanis, Queded, Viladrich, & Duda, 2016; Cornick, 2015). In confirmatory bi-factor analysis (CBFA), researchers are required to specify, and therefore impose, a bi-factor structure based on a complete a priori substantive measurement theory. Figure 1 depicts the a priori measurement theory for responses to the I COPPE Scale from a CBFA perspective.

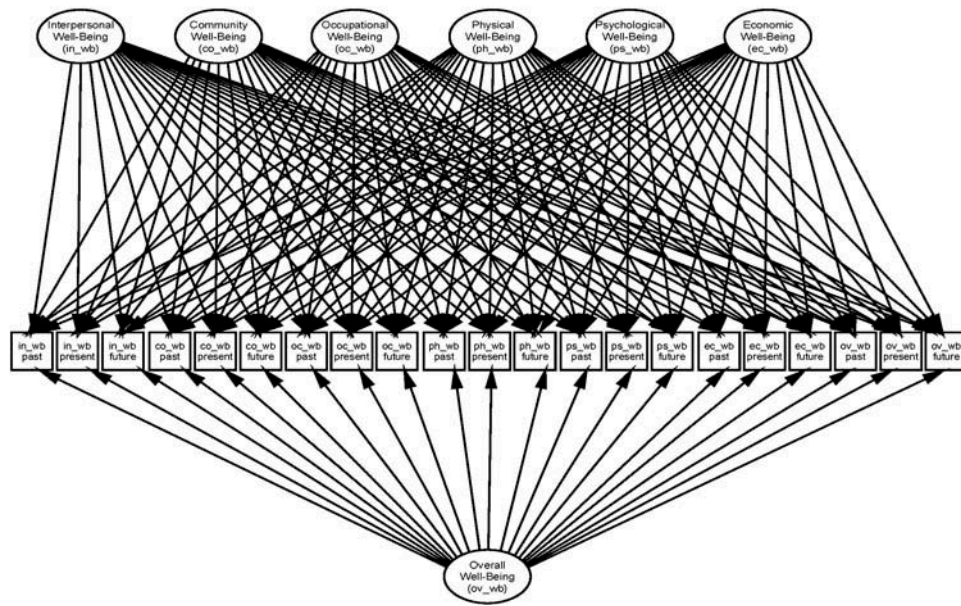
The exploratory form of the bi-factor model was put forth because the complete a priori substantive measurement theory that is required under a CBFA often is incomplete in practice (Jennrich & Bentler, 2011). Exploratory bi-factor analysis (EBFA) is an exploratory factor analysis (EFA) with a bi-factor rotation criterion. Exploratory structural equation modeling (ESEM; Asparouhov & Muthén, 2009) has recently been put forth as a way to place EFA within the broader structural equation modelling (SEM) framework. Thus, recent methodological developments that allow EBFA, in addition to CBFA, provide flexibility to accommodate the incomplete substantive measurement theory (e.g., when unsure if an item cross-loads on an unintended factor) that is often observed in the study of human movement (e.g., Myers, Ahn, & Jin, 2011). Figure 2 depicts the a priori measurement theory for responses to the I COPPE Scale from an EBFA perspective, which

allows, but does not impose, a bi-factor structure to emerge. Formally testing the two measurement theories proposed for responses to the I COPPE Scale depicted in Figure 1 and Figure 2 would fit within a theory testing framework that has long been advocated in the study of human movement (e.g., Landers, 1983) and would investigate another standard for validity in testing—evidence for the internal structure of an instrument (AERA et al., 2014). A higher-order measurement theory, where a second-order overall well-being factor exerted direct effects on first-order factors (e.g., interpersonal well-being) was not of a priori interest in the current study (but often is of interest in exercise science; Myers et al., 2014) because a typical parameterization of such a model would be unlikely to specify direct effects from overall well-being to most I COPPE Scale items (Yung, Thissen, & McLeod, 1999).

Another standard for validity in testing that was relevant to the current study is that evidence for relationships with conceptually related constructs should be provided for each of the population(s) for which an instrument is intended (AERA et al., 2014). Prilleltensky et al. (2015) provided evidence for statistically significant and positive bivariate correlations, ranging from .43 to .74, between factors derived from responses to the I COPPE Scale and comparison measures in a sample that was composed of almost entirely (i.e., 83%) White/Caucasian Americans. Hispanics are a population for which the I COPPE Scale is intended but for which evidence regarding relationships with conceptually related constructs does not yet exist. Providing evidence for hypothesized theory-based relationships in a diversity of populations, particularly those for which health disparities (e.g., those related to physical inactivity) may exist,



**Figure 1.** A priori measurement theory for responses to the I COPPE Scale from a CBFA perspective. Model parameters (e.g., variances) and identification constraints sometimes were omitted to reduce clutter.



**Figure 2.** A priori measurement theory for responses to the I COPPE Scale from an EBFA perspective. Model parameters (e.g., variances) and identification constraints sometimes were omitted to reduce clutter.

has long been an important endeavor in the study of human movement (Cardinal, 2015).

A final standard for validity in testing that was relevant to the current study is that precision of relevant parameter estimates (e.g., factor loadings, etc.) should be documented (AERA et al., 2014). Similarly and within the study of human movement, Myers et al. (2011) advocated that after a measurement model is accepted an important aspect of the development of an instrument is to determine the sample size ( $N$ ) needed to achieve a particular level of power for subsequent related studies. Rules of thumb (e.g.,  $N \geq 200$ ) for determining adequate  $N$  for a particular application of factor analysis with real data are known to be of limited use (e.g., Marsh et al., 2010). Monte Carlo methods can be used in real data analysis to determine a necessary  $N$  and/or to estimate power (Muthén & Muthén, 2002). The importance of implementing an empirically-based approach has been demonstrated in the study of human movement (Myers et al., 2011) but has yet to be documented with regard to the I COPPE Scale.

### Research questions

**Research question 1.** Does the a priori measurement theory for responses to the I COPPE Scale emerge in a flexible, yet non-parsimonious, EBFA?

**Research question 2.** Does a more restrictive and parsimonious CBFA that imposes the a priori measurement theory for responses to the I COPPE Scale offer a viable alternative to the EBFA?

**Research question 3.** Do the seven I COPPE well-being factors exhibit convergent relationships with scores from established comparison instruments (detailed in the subsequent section entitled Comparison Instruments) designed to measure conceptually related constructs?

**Research question 4.** What would be the minimum necessary  $N$  for a desired level of power for an entire set of parameters of interest based on key results from the final model?

### Method

An institutional review board provided necessary permission to conduct the study described in this article. Participants were recruited through two panel recruitment companies (i.e., Clear Voice Research and Survey Sampling International) that directed participants to a survey website established by an online survey software company (i.e., Qualtrics). Participants were informed that the purpose of the study was to test the validity of a well-being survey and were assured of confidentiality for their responses. The survey battery included the I COPPE Scale and an established comparison instrument for each of the dimensions that the I COPPE Scale purports to measure. Upon completion of the battery, each participant received \$1 from the panel recruitment company.

Participants were 641 English-speaking adults who identified as Hispanic and resided in the United States.

Participants (354 female, 287 male) ranged from 19 to 83 years of age ( $M = 41.04$ ,  $SD = 13.97$ ). More than one half of participants were married ( $n = 312$ ) or living with a partner ( $n = 57$ ) while the remainder of participants identified as single ( $n = 182$ ) or divorced ( $n = 65$ ) or widowed ( $n = 20$ ) or separated ( $n = 5$ ). Approximately two thirds of participants were employed full- ( $n = 321$ ) or part-time ( $n = 92$ ) while the remainder of participants identified as unemployed ( $n = 164$ ) or retired ( $n = 64$ ). The most frequently observed occupation categories of participants included management ( $n = 191$ ), service ( $n = 157$ ), and sales ( $n = 111$ ). The most frequently observed household income categories of participants included less than \$50,000 ( $n = 316$ ), \$50,000–\$100,000 ( $n = 203$ ) and more than \$100,000 ( $n = 87$ ).

### **I COPPE Scale**

This scale consisted of 21 items. Each of the seven dimensions, overall well-being (*ov\_wb*), interpersonal well-being (*in\_wb*), community well-being (*co\_wb*), occupational well-being (*oc\_wb*), physical well-being (*ph\_wb*), psychological well-being (*ps\_wb*), and economic well-being (*ec\_wb*), was measured with a unique item stem that referenced three different time periods: past (*pa*), present (*pr*), and future (*fu*). For example, the item stem for the three *ph\_wb* items was: When it comes to your physical health and wellness, on which number ... *did you stand a year ago* (*ph\_wb\_pa*); *do you stand now?* (*ph\_wb\_pr*); *will you stand a year from now?* (*ph\_wb\_fu*). Responses to all items followed an 11-category rating scale structure: from 0 (*worst your life can be*) to 10 (*best your life can be*). Residuals for each pair of items that shared a time period (e.g., *ph\_wb\_pa* and *ps\_wb\_pa*) were free to covary based on evidence provided by Prilleltensky et al. (2015) for three method effects (i.e., *pa*, *fu*, *pr*).

### **Comparison instruments**

A comparison measure (i.e., a composite score) for each of the seven dimensions of well-being purportedly measured by the I COPPE Scale was provided by an established instrument. Each composite score was constructed by creating a total test score for each participant (i.e., summing responses to each indicator within an established instrument). From this point forward the exclusion of “well-being” from comparison measures (e.g., overall) was done in an effort to distinguish conceptually related constructs from measures derived from responses to the I COPPE Scale (e.g., *ov\_wb*). The Satisfaction with Life Scale (Diener et al., 1985) provided the comparison measure (i.e., overall) for *ov\_wb*. The

Satisfaction with Life Scale has been used in Hispanic samples in previous research (e.g., Vázquez, Duque, & Hervás, 2013). The Social Connectedness Scale-Revised (Lee, Draper, & Lee, 2001) provided the comparison measure (i.e., interpersonal) for *in\_wb*. The Social Connectedness Scale-Revised has been used in Hispanic samples in previous research (e.g., Yoon, Jung, Lee, & Felix-Mora, 2012). The Brief Sense of Community Scale (Peterson, Speer, & McMillan, 2008) provided the comparison measure (i.e., community) for *co\_wb*. The Brief Sense of Community Scale has been used in Hispanic samples in previous research (e.g., Rivera-Segarra, Rivera-Medina, & Varas-Díaz, 2016). The Abridged Job in General Scale (Stanton et al., 2002) provided the comparison measure (i.e., occupational) for *oc\_wb*. The Short Form Health Survey (Ware, Kosinski, & Keller, 1996) provided the comparison measure (i.e., physical) for *ph\_wb*. The Short Form Health Survey has been used in Hispanic samples in previous research (e.g., Arocho & McMillan, 1998). The Flourishing Scale (e.g., Diener, 2012) provided the comparison measure (i.e., psychological) for *ps\_wb*. The Flourishing Scale has been used in Hispanic samples in previous research (e.g., Silva & Caetano, 2013). The Personal Financial Well-being Scale (Prawitz et al., 2006) provided the comparison measure (i.e., economic) for *ec\_wb*. Acronyms introduced in this and the previous paragraph for I COPPE factors (e.g., *ov\_wb*) and items (e.g., *ov\_wb\_pa*) generally are not used from this point forward in the main text in an effort to improve flow but are used in the tables.

### **Missing data**

Missing data comprised 2.4% of the cells in the raw data matrix (i.e., 427 of 17,948 cells). Missing data ranged from 0% to 5.9% at the variable level. Missing data were addressed from this point forward with the relevant default approach (e.g., full information maximum likelihood using the observed information matrix) in *Mplus* 7.31 (Muthén & Muthén, 1998–2012) under the assumption of missing at random (Schafer & Graham, 2002). Given the relatively small amount of missing data observed, the authors of this article believe that it is unlikely that the unknown mechanism(s) underlying the missing data exerted substantial influence on subsequent results (e.g., Schafer & Graham, 2002).

### **Model-data fit**

Models were fit in *Mplus* under maximum-likelihood estimation with a correction for non-normality so that standard errors for parameter estimates and the test

statistic for exact fit could be appropriately adjusted. Indexes of model-data fit considered were:  $\chi^2_R$ , RMSEA (Root Mean Square Error of Approximation), SRMR (Standardized Root Mean Square Residual), CFI (comparative fit index), and TLI (Tucker Lewis Index). Heuristic classifications model-data fit (e.g., likelihood-based “exact” fit test; the RMSEA-based “close” fit test where  $H_0: \epsilon = .05$  is tested, etc.) were consistent with general recommendations (e.g., Hu & Bentler, 1999). Nested models were compared with the change in the likelihood ratio  $\chi^2$  (robust) test,  $\Delta\chi^2_R$ . Consistent with Marsh et al. (2010),  $\Delta CFI \leq -.01$ ,  $\Delta TLI \leq .00$ , and  $\Delta RMSEA \geq .015$ , was interpreted as evidence in favor of the more complex model.

### Effect size

Effect size was considered in three ways. First, an approach for determining the percentage of common variance in the items accounted for by the group factor and the set of general factors (see pp. 686–687 in Reise, 2012 for details) was applied to the accepted measurement model. Second, a pattern coefficient had to meet two criteria to be determined to be meaningfully large: (a) statistically significant and (b) the absolute value of the standardized coefficient  $> .20$ . The latter criterion is somewhat arbitrary but is consistent with Jennrich and Bentler (2012). Third, a correlation coefficient had to meet two criteria to be determined to be meaningfully large with regard to evidence for a convergent relationship: (a) statistically significant and (b) the absolute value was  $> .20$ , which is similar to other somewhat arbitrary classifications (e.g., J. Cohen, 1988). Type I error rate was set to .05 for each null hypothesis test. We acknowledge that effect size categorizations are somewhat arbitrary and that other scholars (e.g., Brown, 2006; Zhu, 2012b) may prefer alternative categorization schemes that if adopted in this study could have changed interpretation of some results in the current article.

### Research question 1

An EBFA was imposed initially because the complete a priori knowledge that is required under a CBFA for separating the I COPPE items into groups was viewed as potentially incomplete. The difference between how the group factors were specified in the EBFA (see Figure 2) versus the CBFA (see Figure 1) illustrated this point. The EBFA allowed all six group factors to directly influence each of the 21 items.

An EBFA-related issue was selection of a rotation criterion. The authors of this article are aware of three

rotation criteria that have been used in EBFA: bi-quartimin (Jennrich & Bentler, 2011), bi-geomin (Jennrich & Bentler, 2012), and target (Reise, Moore, & Haviland, 2010). In each case the rotation criterion can be orthogonal or oblique but in the oblique case the general factor remains orthogonal to the group factors. For a given model, model-data fit was equivalent under each rotation criterion because rotation occurs after the model is estimated. Thus, results from various rotation criteria were considered with regard to the a priori measurement theory. Target rotation fully specified the target matrix for the group factors in accord with a priori theory (e.g., each interpersonal well-being item was targeted to have a pattern coefficient = 1.25 on interpersonal well-being and = .00 on all other group factors) because simulation research suggests that EFA factors may be defined more consistent with a well-developed a priori theory with an increasing number of targets (Myers, Ahn, & Jin, 2013). The final set of targeted values was derived from an iterative approach guided by human judgment (Browne, 2001).

### Research question 2

The CBFA allowed each group factor to directly influence only those three items that were intended to indicate a particular group factor (e.g., each interpersonal well-being item loaded on interpersonal well-being only). Thus, the CBFA imposed a pattern matrix with bi-factor structure whereas the EBFA allowed a pattern matrix with bi-factor structure to emerge but did not force it to emerge. The CBFA estimated 87 fewer unrotated pattern coefficients as compared to the EBFA that it was nested within.

### Research question 3

The third research question flowed directly from the comparison of the EBFA (first research question) and the CBFA (second research question). The seven comparison measures were added to the accepted measurement model to determine the degree to which there was evidence for convergent relationships between I COPPE well-being factors and conceptually related constructs. Each comparison measure was free to covary with each of the seven I COPPE factors (and with other comparison measures) in the full model. The full model freely estimated 315 model parameters.

A latent variable model was not imposed on responses to the comparison instruments for two key reasons. First, imposing a latent variable model on responses to each of the comparison instruments while imposing a latent variable model imposed on

responses to the I COPPE Scale would have resulted in an even larger (e.g., 14 latent variables, 89 observed variables, and several hundred freely estimated parameters), and perhaps unstable, model in this study—given the moderately sized sample. Second, the composite score approach taken in the current study parallels previous investigation of this research question with a sample drawn from a different population (Prilleltensky et al., 2015). A consequence of the approach taken in the current study, however, is that validity evidence for measuring multidimensional subjective well-being—via the comparison instruments—in the Hispanic sample from the current study was restricted to the composite score approach taken.

#### Research question 4

A minimum necessary  $N$  for a desired level of power ( $\pi$ ) was determined for an entire set of parameters of interest (where  $\theta_i$  was a particular parameter of interest) based on key results from the final model. Parameters of interest were pattern coefficients that were meaningfully large and the seven correlation coefficients that corresponded to the seven comparison measures introduced in the third research question. Monte Carlo methods were used to determine the minimum  $N$  at which each  $H_0 : \theta_i = 0$  was rejected in at least 80% of the replications. Number of replications was set to 10,000. The approach was consistent with Muthén and Muthén (2002).

### Results

Table 1 provides descriptive statistics from the 21 I COPPE Scale items and the seven comparison measures. Cronbach's (1951) alpha ranged from .82 (i.e., economic well-being) to .88 (i.e., interpersonal well-being) for the seven composite scores from the I COPPE Scale and from .87 (i.e., occupation) to .95 (i.e., economic) for the seven composite scores from the comparison measures. McDonald's (1970) coefficient omega ranged from .83 (i.e., economic well-being) to .88 (i.e., interpersonal well-being) for the seven composite scores from the I COPPE Scale and from .87 (i.e., occupation) to .95 (i.e., economic) for the seven composite scores from the comparison measures.

#### Research question 1

There was evidence for exact fit of the EBFA:  $\chi_R^2(21) = 21$ ,  $p = .455$ , RMSEA = .002 (CI<sub>90%</sub> = .000-.034),  $p = .999$ , SRMR = .007, CFI = 1.00, and TLI = 1.00.

#### Research question 2

There was evidence for close fit of the CBFA:  $\chi_R^2(108) = 246$ ,  $p < .001$ , RMSEA = .045 (CI<sub>90%</sub> = .037-.052),  $p = .880$ , SRMR = .042, CFI = .977, and TLI = .956. The CBFA, however, exhibited statistically significant worse fit than the EBFA:  $\Delta\chi_R^2(87) = 233$ ,  $p < .001$ ; and  $\Delta$ CFI = -.023,  $\Delta$ TLI = -.044, and  $\Delta$ RMSEA = .043. A second-order factor model, where overall well-being (i.e., the second-order factor) exerted direct effects on the six I COPPE well-being factors (i.e., the first-order factors) and on the three items intended to measure overall well-being, exhibited statistically significant worse fit than the EBFA:  $\Delta\chi_R^2(99) = 253$ ,  $p < .001$ .

The EBFA was the accepted measurement model. Orthogonal target rotation produced a pattern matrix that generally was consistent with a priori expectations (i.e., compare Table 2 to Figure 1). Standardized pattern coefficients from the general factor, labeled overall well-being, ranged from .36 to .97 with the three largest coefficients coming from the three items explicitly designed to measure overall well-being. The overall well-being factor accounted for 44% of the common variance in the items.

Each of the items also had a meaningful pattern coefficient from the most relevant group factor (see Table 2). Standardized pattern coefficients from the first group factor, labeled interpersonal well-being, on the items intended to measure this factor, ranged from .62 to .67. Standardized pattern coefficients from the second group factor, labeled community well-being, on the items intended to measure this factor, ranged from .60 to .82. Standardized pattern coefficients from the third group factor, labeled occupational well-being, on the items intended to measure this factor, ranged from .57 to .71. Standardized pattern coefficients from the fourth group factor, labeled physical well-being, on the items intended to measure this factor, ranged from .55 to .71. Standardized pattern coefficients from the fifth group factor, labeled psychological well-being, on the items intended to measure this factor, ranged from .46 to .68. Standardized pattern coefficients from the sixth group factor, labeled economic well-being, on the items intended to measure this factor, ranged from .43 to .73. The group factors combined to account for 56% of the common variance in the items.

#### Research question 3

The full model exhibited close fit:  $\chi_R^2(119) = 175$ ,  $p < .001$ , RMSEA = .027 (.018, .035),  $p = .999$ , SRMR = .017, CFI = .994, and TLI = .980. Correlations between the I COPPE well-being factors and the comparison measures provided evidence for convergent relationships (see bolded



**Table 1.** I COPPE well-being scale items and comparison measures: Correlations, means, and standard deviations.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1. ov_wb_pr	—																											
2. ov_wb_pa	.68	—																										
3. ov_wb_fu	.72	.48	—																									
4. in_wb_pr	.61	.45	.50	—																								
5. in_wb_pa	.47	.54	.41	.71	—																							
6. in_wb_fu	.52	.35	.62	.76	.65	—																						
7. co_wb_pr	.55	.42	.40	.51	.40	.42	—																					
8. co_wb_pa	.40	.48	.28	.40	.46	.34	.74	—																				
9. co_wb_fu	.50	.34	.51	.47	.37	.55	.78	.58	—																			
10. oc_wb_pr	.63	.48	.46	.47	.39	.39	.44	.39	.44	—																		
11. oc_wb_pa	.48	.54	.35	.39	.43	.31	.42	.47	.36	.73	—																	
12. oc_wb_fu	.54	.38	.62	.46	.38	.54	.41	.31	.51	.72	.62	—																
13. ph_wb_pr	.63	.48	.57	.47	.36	.40	.49	.36	.46	.54	.43	.51	—															
14. ph_wb_pa	.44	.54	.39	.34	.42	.25	.34	.43	.30	.38	.48	.35	.68	—														
15. ph_wb_fu	.58	.39	.68	.42	.37	.50	.41	.29	.50	.42	.38	.58	.75	.53	—													
16. ps_wb_pr	.74	.46	.59	.60	.47	.51	.58	.42	.49	.54	.38	.51	.66	.46	.57	—												
17. ps_wb_pa	.53	.58	.37	.42	.49	.32	.45	.47	.37	.40	.48	.32	.48	.59	.36	.66	—											
18. ps_wb_fu	.60	.37	.71	.51	.41	.62	.48	.37	.57	.43	.30	.61	.54	.38	.64	.72	.48	—										
19. ec_wb_pr	.70	.53	.46	.50	.40	.37	.46	.36	.37	.63	.47	.45	.55	.38	.40	.60	.46	.41	—									
20. ec_wb_pa	.52	.58	.34	.39	.44	.31	.41	.44	.31	.41	.54	.35	.37	.40	.31	.41	.52	.31	.64	—								
21. ec_wb_fu	.62	.43	.66	.47	.41	.57	.39	.28	.50	.48	.38	.59	.47	.30	.60	.55	.36	.66	.66	.51	—							
22. Overall	.71	.51	.51	.53	.44	.41	.51	.39	.41	.61	.46	.45	.53	.37	.42	.66	.47	.48	.67	.48	.52	—						
23. Interpersonal	.40	.32	.39	.43	.40	.44	.39	.30	.41	.34	.26	.32	.36	.28	.35	.45	.37	.43	.36	.26	.38	.46	—					
24. Community	.34	.29	.24	.31	.28	.24	.53	.43	.39	.35	.26	.25	.31	.24	.21	.38	.30	.26	.40	.32	.27	.48	.45	—				
25. Occupational	.36	.28	.32	.28	.25	.29	.26	.22	.26	.50	.41	.42	.32	.24	.31	.35	.26	.36	.38	.25	.35	.43	.36	.28	—			
26. Physical	.21	.15	.26	.15	.12	.17	.08	.08	.14	.13	.14	.23	.36	.26	.39	.17	.11	.22	.06	.05	.21	.12	.19	.28	.20	—		
27. Psychological	.48	.36	.45	.45	.41	.41	.42	.33	.40	.42	.34	.40	.43	.34	.39	.53	.40	.50	.47	.33	.47	.60	.66	.54	.40	.12	—	
28. Economic	.59	.47	.39	.36	.32	.24	.37	.27	.27	.49	.38	.33	.44	.31	.32	.49	.39	.34	.74	.52	.54	.64	.33	.42	.34	.11	.44	—
M	6.8	6.4	7.6	7.5	7.3	7.9	7.2	7.0	7.5	6.8	6.5	7.4	7.2	6.8	7.7	7.3	7.0	7.9	6.3	6.1	7.3	22.5	82.0	3.4	16.6	50.0	42.9	5.4
SD	2.0	2.2	2.1	2.2	2.2	2.0	2.1	2.2	2.0	2.7	2.6	2.4	2.0	2.3	2.0	2.2	2.2	2.0	2.5	2.4	2.3	7.7	18.3	1.0	7.2	10.7	9.3	2.3

Note. ov = overall; in = interpersonal; co = community; oc = occupational; ph = physical; ps = psychological; ec = economic; wb = well-being; pr = present; pa = past; fu = future. A correlation > .07 was statistically significant ( $\alpha = .05$ ).

**Table 2.** I COPPE well-being scale under EBFA with orthogonal target rotation in the final model.

Item/PCVE	Overall well-being (ov_wb)		Interpersonal well-being (in_wb)		Community well-being (co_wb)		Occupational well-being (oc_wb)		Physical well-being (ph_wb)		Psychological well-being (ps_wb)		Economic well-being (ec_wb)		R <sup>2</sup>
	$\lambda^0$	SE	$\lambda^0$	SE	$\lambda^0$	SE	$\lambda^0$	SE	$\lambda^0$	SE	$\lambda^0$	SE	$\lambda^0$	SE	
ov_wb_pr	.97	.04	.03	.03	.01	.03	.06	.03	.05	.04	.14	.03	.17	.04	99%
ov_wb_pa	.66	.04	.05	.04	.04	.04	.08	.04	.08	.04	-.01	.04	.20	.04	49%
ov_wb_fu	.70	.03	.13	.04	-.03	.03	.05	.04	.19	.04	.13	.04	.04	.04	57%
in_wb_pr	.56	.03	.66	.03	.13	.03	.10	.03	.05	.03	.15	.04	.12	.03	81%
in_wb_pa	.42	.03	.62	.03	.11	.03	.10	.03	.05	.03	.12	.03	.13	.03	62%
in_wb_fu	.49	.03	.67	.03	.11	.03	.06	.03	.07	.03	.11	.03	.03	.03	73%
co_wb_pr	.52	.04	.08	.03	.82	.03	.11	.03	.08	.03	.13	.03	.12	.03	99%
co_wb_pa	.36	.04	.12	.03	.62	.04	.10	.03	.05	.04	.13	.04	.08	.03	56%
co_wb_fu	.48	.03	.15	.03	.60	.04	.10	.03	.11	.03	.12	.03	.01	.03	64%
oc_wb_pr	.57	.04	.04	.03	.12	.03	.71	.03	.03	.03	.14	.04	.18	.03	89%
oc_wb_pa	.42	.04	.07	.03	.12	.03	.63	.03	.12	.03	-.03	.03	.15	.03	64%
oc_wb_fu	.48	.03	.15	.03	.06	.03	.57	.03	.18	.03	.11	.03	.05	.03	64%
ph_wb_pr	.58	.04	.03	.03	.11	.03	.11	.03	.71	.04	.19	.03	.13	.03	92%
ph_wb_pa	.39	.04	.03	.03	.07	.03	.12	.03	.55	.04	.13	.03	.09	.03	49%
ph_wb_fu	.53	.03	.12	.04	.06	.03	.11	.03	.56	.04	.15	.03	.01	.03	65%
ps_wb_pr	.62	.04	.13	.03	.10	.03	.11	.03	.17	.04	.68	.04	.15	.03	94%
ps_wb_pa	.44	.04	.07	.03	.15	.04	.05	.03	.13	.04	.46	.04	.16	.04	47%
ps_wb_fu	.53	.04	.18	.04	.13	.03	.06	.03	.17	.04	.46	.04	.02	.04	57%
ec_wb_pr	.55	.04	.06	.03	.08	.03	.18	.03	.09	.04	.14	.03	.73	.03	90%
ec_wb_pa	.43	.04	.08	.04	.11	.03	.09	.03	.04	.04	.03	.03	.52	.04	48%
ec_wb_fu	.53	.03	.15	.04	.01	.03	.12	.04	.10	.04	.16	.03	.43	.04	53%
PCVE	44%				56%										

Note. pr = present; pa = past; fu = future; PCVE = percentage of common variance explained;  $\lambda^0$  = standardized pattern coefficient. An estimated  $\lambda^0$  was bolded in the table only if the absolute value was  $> .20$  and it was statistically significant ( $\alpha = .05$ ).

values along the main diagonal in Table 3). More specifically, the correlation between each I COPPE factor and the corresponding comparison measure ranged from .26 (i.e.,  $\hat{\psi}_{interpersonal\ well-being, interpersonal}$ ) to .63 (i.e.,  $\hat{\psi}_{overall\ well-being, overall}$ ).

#### Research question 4

Parameters of interest were the 39 pattern coefficients for which estimates were depicted in Table 2 and the seven correlation coefficients that were bolded in Table 3. All parameter estimates (whether of interest or not) from the full model, however, were treated as the population values. A modest  $N$  provided more than sufficient power for all 48

parameters of interest, specifically, for each of the 48 parameters of interest  $\hat{\pi} \geq .80$  when  $N = 130$ . A reasonable answer to the fourth research question was that an  $N$  of at least 130 is recommended in subsequent related studies. It should be noted, however, that an  $N < 200$  is sometimes cautioned against because there is evidence that the percentage of acceptable solutions may drop dramatically under certain conditions (e.g., Velicer & Fava, 1998). In the current study, however, 84% (90%) of solutions were acceptable when  $N = 130$  ( $N = 150$ ).

#### Discussion

The purpose of this study was to provide initial validity evidence for measuring multidimensional subjective

**Table 3.** Correlations between I COPPE well-being factors and comparison measures in the final model.

Comparison measure	I COPPE factors						
	Overall well-being	Interpersonal well-being	Community well-being	Occupational well-being	Physical well-being	Psychological well-being	Economic well-being
Overall <sup>a</sup>	.63	.10	.10	.20	.05	.24	.33
Interpersonal <sup>b</sup>	.34	.26	.17	.07	.10	.22	.12
Community <sup>c</sup>	.28	.07	.39	.11	.04	.16	.23
Occupational <sup>d</sup>	.30	.07	.02	.36	.08	.13	.16
Physical <sup>e</sup>	.21	.04	-.07	.04	.37	-.02	-.11
Psychological <sup>f</sup>	.39	.19	.15	.13	.13	.27	.23
Economic <sup>g</sup>	.48	-.03	.02	.12	.06	.12	.59

Note. A correlation was statistically significant ( $\alpha = .05$ ) if its absolute value was  $> .07$ . Bolded values correspond to the seven convergent relationships proposed in the third research question.

<sup>a</sup>Responses to the Satisfaction with Life Scale (Diener et al., 1985) provided the overall comparison measure.

<sup>b</sup>Responses to the Social Connectedness Scale-Revised (Lee et al., 2001) provided the interpersonal comparison measure.

<sup>c</sup>Responses to the Brief Sense of Community Scale (Peterson et al., 2008) provided the community comparison measure.

<sup>d</sup>Responses to the Abridged Job in General Scale (Stanton et al., 2002) provided the occupational comparison measure.

<sup>e</sup>Responses to the Short Form Health Survey (Ware et al., 1996) provided the physical comparison measure.

<sup>f</sup>Responses to the Flourishing Scale (Diener, 2012) provided the psychological comparison measure.

<sup>g</sup>Responses to the Personal Financial Well-being Scale (Prawitz et al., 2006) provided the economic comparison measure.

well-being in a Hispanic sample with the I COPPE Scale.

Accomplishing this purpose was important because there is reason to believe that use of the I COPPE Scale may be relevant within the study of human movement and because the Hispanic population is a population for which use of the I COPPE Scale is intended but for which validity evidence does not yet exist. Preliminary evidence for the a priori hypothesized measurement theory for responses to the I COPPE Scale and for convergent relationships between I COPPE factors and scores from established comparison instruments was put forth with bi-factor analyses. There are limits, however, to the evidence provided.

Evidence for the internal structure of a measurement instrument has been described as "... the degree to which the relationships among test items and test components conform to the construct on which the proposed test score interpretations are based" (AERA et al., 2014, p. 16). The first two research questions in the current study evaluated evidence for the internal structure of responses to the I COPPE Scale in a Hispanic sample. A reasonable answer to the first two research questions was that there was evidence that the restrictive confirmatory form of the bi-factor model that imposed the a priori hypothesized measurement theory for responses to the I COPPE Scale did not offer a better fitting alternative to a more flexible exploratory form of the bi-factor model. It is interesting to consider our answer to the first two research questions, given that none of the I COPPE items had a meaningful pattern coefficient on an unintended I COPPE group factor in the EBFA (see Table 2). Such an observation, while somewhat counterintuitive, may be relatively common in bi-factor applications in the study of human movement where there may be several unintended and small pattern coefficients that individually may be considered negligible but collectively are considered meaningful (e.g., Myers et al., 2014). A possible implication for future research is that the a priori measurement theory for responses to the I COPPE Scale may be more consistent with the observed data if modeled in a flexible and non-parsimonious factor model (e.g., EBFA) as compared to a more restrictive and parsimonious factor model (e.g., CBFA).

Evidence based on the relations of measures derived from a measurement instrument with variables external to the measurement instrument has been described as, "Relationships between test scores and other measures intended to assess the same or similar constructs provide convergent evidence, whereas relationships between test scores and measures purportedly of different constructs provide discriminant evidence" (AERA

et al., 2014, pp. 16–17). The third research question in the current study evaluated evidence for convergent relationships between the seven I COPPE subjective well-being factors and scores from established comparison instruments in a Hispanic sample. A reasonable answer to the third research question was that evidence was observed for convergent relationships between the I COPPE well-being factors and scores from established comparison instruments designed to measure conceptually related constructs. It is interesting to note that while the current study did not explicitly focus on discriminant relationships, evidence for such relationships was observed. More specifically, the correlation between each I COPPE factor and each of the non-corresponding comparison measures (e.g.,  $\hat{\psi}_{\text{physical well-being, overall}} = .05$ ,  $\hat{\psi}_{\text{physical well-being, interpersonal}} = .10$ , etc.) was always smaller than the correlation between a given I COPPE factor and the corresponding comparison measure (i.e., each correlation in the fifth column of Table 3 was less than  $\hat{\psi}_{\text{physical well-being, physical}} = .37$ ). A possible implication for future research is the existence of a stronger foundation of validity evidence from which future studies may be designed to promote multidimensional well-being in a universal intervention and within a randomized controlled trial design.

The authors of this study are aware of four primary limitations for the initial validity evidence provided in this study for measuring multidimensional well-being in a Hispanic sample with the I COPPE Scale. The first limitation was the complete reliance on subjective measures of well-being. Future research that includes objective measures of well-being, along with subjective measures of well-being for comparison purposes, would follow recommendations to address similar issues encountered in the measurement of sedentary behavior (Kang & Rowe, 2015). How "objective" well-being is operationally defined is an interesting and unresolved question but proposed indicators (e.g., secretory immunoglobulin A) of such a construct have been observed in the human movement literature (e.g., Healy, Ntoumanis, Veldhuijzen van Zanten, & Paine, 2014). The second limitation was the strong possibility that a less than optimal rating scale categorization structure was used to govern responses to the I COPPE Scale. Specifically there was evidence in the current study, as well as in Prilleltensky et al. (2015), that the lower end of the rating scale may be used very infrequently by participants when responding to the I COPPE Scale. The psychometric importance of an effective rating scale structure is well-known in the study of human movement (e.g., Zhu, Timm, & Ainsworth, 2001) and should be investigated with regard to future use of the I COPPE Scale. Specifically, the authors of this article believe that a five

category response structure in future research with the I COPPE Scale may be effective based on previous research on rating scale effectiveness in human movement (e.g., Myers, Feltz, & Wolfe, 2008). The third limitation was the assumption that the sample of Hispanic participants in the current study were drawn from a homogenous population with regard to ethnicity. Moreover, it should be noted that there is some debate about the utility of racial and/or ethnic categorizations in general (e.g., Dividio, Jones, & Vietze, 2014).

The fourth limitation of the current study is that the magnitude of some parameter estimates in Tables 2 and 3 may be difficult to compare directly to results from Prilleltensky et al. (2015) due to a difference in rotation criterion. Authors of the current study selected orthogonal target rotation specified consistent with a bi-factor structure, while Prilleltensky et al. reported results from oblique geomin rotation (i.e., a correlated first-order factors model). While “selecting a particular rotation criterion is a multi-faceted post estimation decision that cannot be proven to be ‘correct’ when population values are unknown” (Myers, 2013, p. 716), there is some utility in making results as comparable as is possible across studies. For this reason correlations between I COPPE well-being factors under oblique geomin rotation and comparison measures in the final model were estimated post hoc and ranged from .40 (i.e.,  $\hat{\psi}_{\text{physical well-being, physical}}$ ) to .77 (i.e.,  $\hat{\psi}_{\text{economic well-being, economic}}$ ). While these correlations are larger than the relevant correlation values listed along the diagonal in Table 3—which ranged from .26 (i.e.,  $\hat{\psi}_{\text{interpersonal well-being, interpersonal}}$ ) to .63 (i.e.,  $\hat{\psi}_{\text{overall well-being, overall}}$ )—the correlations between I COPPE well-being factors should also be considered and ranged from .40 (i.e.,  $\hat{\psi}_{\text{interpersonal well-being, economic well-being}}$ ) to .68 (i.e.,  $\hat{\psi}_{\text{psychological well-being, overall well-being}}$ ) under oblique geomin rotation. Thus, the correlation between each I COPPE factor and the corresponding comparison measure in Table 3 can be viewed as the *unique* correlation between a particular I COPPE well-being factor and a corresponding comparison measure. While some of the results from the current study may be difficult to compare to results from Prilleltensky et al. due to a difference in rotation criterion, “It should be reiterated that there is no right or wrong rotation criterion from a mathematical perspective in regard to model-data fit.” (Myers, 2013, p. 716). More broadly, the specific form of any measurement model imposed on responses to the I COPPE Scale in any future study (e.g., EBFA, a higher-order factor model, manifest variables, etc.) should be informed by research question(s) imposed in the study, results from a well-designed sample size determination for a desired

level of power analysis, and results from previous related research.

There is much work yet to do to investigate the full utility of the I COPPE Scale in the interdisciplinary study of human movement. An important area for future research may be to directly compare convergent evidence for measures derived from the I COPPE Scale to measures derived from other instruments more frequently used in the interdisciplinary study of human movement such as the PANAS, SVS, and the Athlete Burnout Questionnaire (ABQ; Raedeker & Smith, 2001). Another important area for future research may be to assess the feasibility of, and efficacy for, using the I COPPE Scale in various athletic (e.g., sport-, exercise-, or performance-based) and international populations. We expect that there may be several scenarios where instruments other than the I COPPE Scale (e.g., ABQ) may be preferable because such instruments may delve deeper into one or more particular dimensions of well-being (e.g., physical, psychological, emotional, etc.) and in a manner that is more tailored to an athletic population. That said, we also believe that use of the I COPPE Scale to derive multidimensional measures of well-being may be of potential utility to a considerable amount of future research in interdisciplinary study of human movement.

In summary, the current study provided initial validity evidence for measuring multidimensional subjective well-being in a Hispanic sample with the I COPPE Scale and in so doing extended the literature in at least two ways. The first extension of the literature was based on the observation that the evidence observed for the model-data fit of the EBFA in the current study extended evidence provided by Prilleltensky et al. (2015). Results from both the current study and Prilleltensky et al. combine to provide initial support for the proposed internal structure of responses to the I COPPE Scale in both Hispanic and White/Caucasian populations, respectively. Similarly, the second extension of the literature was based on the observation that the evidence observed for relations of the seven I COPPE subjective well-being factors to external variables in the current study extended evidence provided by Prilleltensky et al. Results from both the current study and Prilleltensky et al. combine to provide initial support—with limits given the difference in selected rotation criterion—for this important facet of validity evidence in both Hispanic and White/Caucasian populations, respectively. In summary, the extensions of the literature put forth in the current study suggest that use of the I COPPE Scale to derive multidimensional measures of subjective well-being may be of potential utility (e.g., greater consistency in

test selection) to future research in the interdisciplinary study of human movement and in a diversity of populations in which health disparities may exist.

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