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Measuring College Belongingness: Structure and Measurement of the Sense of Social Fit Scale

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Sense of belonging is theorized to be a fundamental human need and has been shown to have important implications in many domains of life, including academic achievement. The Sense of Social Fit scale (SSF; Walton & Cohen, 2007) is widely used to assess college belongingness, particularly to study differences in academic experiences along lines of gender and race. Despite its wide use, the instrument's latent factor structure and measurement invariance properties have not been reported in the published literature to date. Consequently, researchers regularly use subsets of the SSF's items without psychometric justification. Here, we explore and validate the SSF's factor structure and other psychometric properties, and we provide recommendations about how to score the measure. A one-factor model in Study 1 showed poor fit, and exploratory factor analyses extracted a four-factor solution. Study 2's confirmatory factor analyses demonstrated superior fit of a bifactor model with four specific factors (from Study 1) and one general factor. Ancillary analyses supported a total scale scoring method for the SSF and did not support computing raw subscale scores. We also tested the bifactor model's measurement invariance across gender and race, compared latent mean scores between groups, and established the model's criterion and concurrent validity. We discuss implications and suggestions for future research.

Public Significance Statement

We show that the SSF measures diverse college students' general college belonging and specific factors including Identification with the University, Social Match, Social Acceptance, and Cultural Capital. We validate our multidimensional model among various demographic groups and with existing measures of belonging and related constructs. Findings may help psychologists understand, measure, and support college student belonging with greater precision.

Keywords: measurement invariance, factor analysis, sense of belonging, college belonging

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Belongingness has a rich history of discourse in psychology (Stone Brown, 2014). It has been defined as "the experience of personal involvement in a system or environment so that persons feel themselves to be an integral part of that system or environment" (Hagerty et al., 1992, p. 173). A topic of interest among researchers, it is associated with psychological well-being, academic achievement, and life satisfaction, among other outcomes (Baumeister & Leary, 1995). Psychologists studying school belonging, in particular, use various definitions of this construct. Some definitions focus on perceived social acceptance (SA; Goodenow, 1993) while others include a sense of classroom comfort (Hoffman et al., 2002). Moreover, some studies treat belongingness as the opposite of experiencing uncertainty about one's belonging (Talaifar et al., 2021), while others treat these two as distinct constructs (Walton & Cohen, 2011). If researchers are to deepen their understanding of college belonging, then it is paramount to attend to its operationalization.

The Sense of Social Fit scale (SSF; Walton & Cohen, 2007), a measure of college belonging, has gained popularity among researchers

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This study was not preregistered. Study data and analysis codes are available from authors upon request.

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interested in understanding psychological aspects of educational inequities in postsecondary education. It has been used with a diverse range of students, including first-generation (Stephens et al., 2014) and racial–ethnic minoritized (Walton & Cohen, 2011) college students. Walton and Cohen (2007) briefly reported the results of a factor analysis combining the SSF items with nine other items assessing social fit, self-efficacy, academic identification, and potential to succeed in one's major. The authors adopted a single-factor model for the combined item pool, noting that all items loaded strongly on the first factor.

Walton and Cohen's (2007) development of the SSF contributed much to the literature on college belonging, and we note aspects of the study that warrant further analyses. First, the study's sample size ($N = 69$) was restrictively small for factor analysis, and the study did not report the factorability of the data or its satisfaction of the assumptions of the analyses. The authors also noted high factor loadings in their model but did not provide loading estimates or model fit indices. Finally, the authors interpreted differences in mean levels of (and changes in) belonging between Black and White students without establishing measurement invariance of the SSF to justify such comparisons. Thus, there is a need for a careful psychometric evaluation of the SSF.

In the present studies, we examined the latent structure and other psychometric properties of the SSF to address the above concerns and further test the scale's validity. We are unaware of any other published psychometric assessments of the SSF, and a review of the literature shows researchers using various different subsets of the scale's items with little to no psychometric justification. The aims of the present studies were to (a) explore and validate the SSF's factor structure, (b) provide recommendations for how to score the SSF, (c) test its measurement invariance across gender and race, and (d) test its validity with criterion and related measures.

College Belonging

Conceptualization

Although the field is moving closer to a unified definition of college belongingness, psychologists use various terms to describe this construct. Tovar and Simon (2010, p. 200) defined college belonging as "a sense of identification or positioning in relation to a group or to the college community." Highlighting core features of college belongingness, Strayhorn (2018, p. 4) defined college belonging as "students' perceived social support on campus, a feeling or sensation of connectedness, the experience of mattering or feeling cared about, accepted, respected, valued by, and important to the group." The SSF refers to college belonging as "social and academic fit," while the Psychological Sense of School Membership (PSSM; Goodenow, 1993) scale refers to it as "school membership." College belonging has also been described as a need for relatedness (Guiffrida et al., 2008), sense of membership (Hurtado & Carter, 1997), need for community (McMillan & Chavis, 1986), and feeling of integration (Tinto, 2004).

Theory suggests that college belonging may be multidimensional. For example, Strayhorn's (2018) definition implies at least three components: perceived social support, perceived connectedness, and the experience of mattering or feeling cared about. Baumeister and Leary (1995) theorized two necessary components for a person to feel belongingness: frequent interaction with others and persistent caring from others. Last, qualitative work by Vaccaro and Newman (2016) suggests college belonging has at least three components: perceptions of campus environment, supportive peer interactions, and on-campus involvement.

The conceptualizations above focus mostly on social factors, but scholars are increasingly attending to other factors related to belonging. One such factor cultural capital (CC) involves skills and knowledge inherited from cultural brokers like parents or mentors (Yosso, 2005). Education scholars posit that—because predominantly White institutions (PWI) of higher education privilege the CC of certain groups (e.g., White affluent students) over others—this concept is linked to college belonging, particularly for racially minoritized students at PWIs (Strayhorn, 2018). Some researchers treat CC and college belonging as two distinct but closely related concepts (Agbenyega, 2017; Brooms, 2018). Fernández et al. (2023), however, found that while affluent students defined belonging in terms of authenticity and social fit, less socioeconomically privileged students also "recognised CC to be a key dimension of feeling they belonged" (p. 15). Others have also found that students' definitions of belonging are informed by their social identity-based experiences (Vaccaro & Newman, 2016). Thus, the conceptual relation between CC and college belonging remains an open question.

Measurement and Dimensionality

Validity studies of college belongingness scales generally align with theoretical conceptualizations of a multidimensional construct. Including the different terms used for the construct, our literature review points to at least five measures of college belongingness (France et al., 2010; Goodenow, 1993; Hoffman et al., 2002; Slaten et al., 2018; Walton & Cohen, 2007). To date, the most popular of these are the Sense of Belonging Instrument (SBI), SSF, and PSSM.

The 26-item SBI was developed to better understand factors that influence college student retention (Hoffman et al., 2002). Factor analyses of this measure support a three-factor structure: perceived faculty understanding/comfort, peer support, and classroom comfort (Tovar & Simon, 2010). This structure aligns with Strayhorn's (2018) conceptual distinctions between university belonging dimensions of perceived social support (SBI faculty understanding, peer support) and feeling cared about (SBI faculty and classroom comfort).

The PSSM (Goodenow, 1993)—an 18-item measure of adolescents' perceived belonging or sense of membership in school—has been used in diverse contexts with a broad range of secondary and college students (Freeman et al., 2007; Hussain et al., 2018). Factor analysis of the college-adapted PSSM (typically scored as a total scale), yields three factors: valued competence, SA, and involvement (Knekta et al., 2020). This structure mirrors Strayhorn's (2018) distinction between feelings of connectedness (PSSM involvement) and perceived social support (PSSM valued competence, SA).

The SSF, a 17-item measure of college belonging, was developed based on a review of literature on school belonging and motivation (Walton & Cohen, 2007). The SSF is typically scored as a total scale. Like the SBI and PSSM, the SSF aligns with Strayhorn's (2018) conceptualization and centers largely on social connectedness. It expands on these measures by also including items assessing knowledge of how to successfully navigate academic systems.

The above factor analyses of the PSSM and SBI show commonalities among their factors. For example, PSSM's SA factor (e.g., items concerning positive peer relations and feeling that faculty support one's success) coincides with SBI's peer support and faculty understanding/comfort factors (e.g., items concerning peer relationships and perceptions of faculty members as supportive and sensitive to one's difficulties).

An analysis of the SSF's items suggests this measure might also tap multiple dimensions of belonging. Similar to SBI, the SSF contains items about comfort at school ("I feel comfortable at [school]"). And, like both the SBI and PSSM, the SSF contains items tapping social support ("People at [school] accept me"). We expect SSF to yield factors resembling those of the SBI and PSSM, namely school comfort/fit and social support/acceptance. As mentioned above, SSF also assesses knowledge about how to successfully navigate academia (e.g., knowing "how [school] works"). We thus expect the SSF to yield a factor related to these items.

Applied Studies of College Belonging

Similar to other contexts of belonging, college belonging influences many life outcomes. For example, it is positively associated with academic and social self-efficacy (Wurster et al., 2021) as well as better physical health and more health-promoting behaviors (Walton & Cohen, 2011). Belongingness can also function as an emotional support for students processing difficult events such as loss of loved ones (McNally et al., 2021). Thus, college belonging is important for both academic success and psychological well-being.

Though college belongingness impacts students in general, those from underrepresented groups may especially find themselves in environments that threaten their sense of belonging (Strayhorn, 2018). For Native American students, for example, historical educational experiences have been oppressive, colonizing, and violent (Brayboy & Lomawaima, 2018). Ruedas-Gracia et al. (2020) found that Native American adolescents enrolled in a reservation high school reported lower school belonging than non-Native American peers. Additionally, Lewis et al. (2021) found that African American students at a PWI experienced particularly high rates of racism, which negatively impacted their sense of belonging. Similarly, for other minoritized students, researchers have found that marginalization and hostile campus climates affect students' belongingness, academic achievement, and well-being (Burgos-Cienfuegos et al., 2015; Hernandez et al., 2019; Hurtado & Carter, 1997; Stephens et al., 2012). Greater college belongingness also correlates positively with life satisfaction for first-generation college students (Duffy et al., 2020) and negatively with anxiety and depression, with stronger associations for first-generation and racially/ethnically minoritized students (Gopalan et al., 2022).

The Present Study

The SSF (Walton & Cohen, 2007) is popular with researchers, with over 2,500 citations as of November 2022. As others have noted, little is known about its factor structure and other psychometric properties (Knekta et al., 2020; Pyne et al., 2018), resulting in unstandardized usage. Ad hoc selection of subsets of the measure has led to studies with one-item (Destin et al., 2017), three-item (Layous et al., 2017), four-item (Pyne et al., 2018), and six-item (Stephens et al., 2014) versions, all ostensibly measuring the same construct. Among other concerns, the use of unvalidated scales makes it difficult to synthesize results across studies (Clark & Watson, 2019).

We sought to address the knowledge gap regarding the psychometric properties and validity of the SSF. In Study 1, we conducted confirmatory factor analyses (CFA) of the SSF to test the single-factor model originally proposed by the authors, and exploratory factor analyses (EFA) to explore its latent factor structure. We tested the resulting model from Study 1 via CFA procedures on an independent data set in Study 2. We also tested second-order and bifactor models, tested measurement invariance for gender and race, and compared latent means on the SSF factors across subgroups. Finally, we used regression analysis with a criterion measure of belonging and measures of related constructs to test the SSF's criterion and concurrent validity.

Study 1

Study 1 used data from the College Experience Study, conducted at a private predominantly White university (enrolling approximately 7,000 undergraduates and 9,000 graduate students) in the western United States in 2017. Study 1 aimed to explore the SSF's factor structure. As mentioned above, we expected to find a multidimensional factor structure.

Method

Procedure and Participants

Researchers sent recruitment emails to student groups for a study on "the college student experience." In January 2017, 300 randomly selected respondents were sent a link to the survey, resulting in 282 responses. The study was approved by the university's Institutional Review Board. The study was not preregistered. Data and analysis code are available upon request.

In screening the data, we removed participants who fully lacked responses on the SSF (n = 29) or who provided indiscernible responses on free-response demographic items (n = 10). The final dataset had 243 respondents and no missing values on the SSF. This data comprised undergraduate first years (42.8%), sophomores (41.2%), and juniors (16.0%), with a mean age of 19.05 years (SD = 0.89 years). The sample included 75% cisgender (cis) women, 23% cis men, and 2% transgender or gender nonbinary students. Participants self-identified as East Asian (18%), White/European American (16%), Latino/Hispanic (14%), Black/African American (13%), Southeast Asian (7%), South Asian (5%), other (3%), Middle Eastern (<1%), Native American (<1%), or a combination of these categories (23%). Reported annual family income included below $30,000 (15%), $30,000–$100,000 (44%), and greater than $100,000 (40%).

Measures

College Belongingness. We assessed college belongingness with the SSF (Walton & Cohen, 2007), with higher scores indicating a greater sense of belonging. Participants indicated their level of agreement with the 17 items on a 7-point Likert scale. Example items include "People at [University] accept me" and "I belong at [University]." Walton and Cohen (2007) reported reliability of α = .89, similar to that of our sample (α = .90).

Sample Size Considerations

The Kaiser–Meyer–Olkin measure of sampling adequacy (.90) and a significant Bartlett's test of sphericity ($p < .001$) supported the factorability of our data. Monte Carlo studies indicate that, with communalities around .5 ($h^2_{avg} = .52$ in our study) and variable-to-factor ratios ≥3 (ours ranged 3.4–5.7), EFA solutions can stabilize with a sample size of 100–200 (MacCallum et al., 1999). Thus, we deemed our sample size sufficient for EFA.

Results

Descriptive Statistics

The SSF items showed no considerable univariate skew (range [−1.1, 0.6]) or kurtosis (range [−1.0, 1.5]), but the measure showed significant multivariate skew and kurtosis ($b_{1,p} = 47.97$, $p < .001$; $b_{2,p} = 381.72$, $p < .001$). Other item-level descriptive statistics (correlations, means, etc.) are provided in Supplemental Tables S1–S3.

Confirmatory Factor Analysis: Single-Factor Model

We conducted CFA with the *lavaan* package (Rosseel, 2012) in R, using the maximum likelihood estimator with robust corrections (MLR) for its reliable performance with nonnormal data (Brown, 2015). Based on suggestions of Brown (2015) and Hu and Bentler (1999), we evaluated model fit using root-mean-square error of approximation (RMSEA; good fit ≤ .06; adequate fit ≤ .08), standardized root-mean-squared residual (SRMR; good ≤ .08; adequate ≤ .10), and comparative fit (CFI) and Tucker–Lewis (TLI) indices (good ≥ .95; adequate ≥ .90). In case of poor fit, we identified model misspecifications using modification indices and compared the relative fit of nested models with significance tests on $\Delta\chi^2$. We scaled global fit indices and $\Delta\chi^2$ to adjust for MLR estimator (Satorra & Bentler, 2001).

We first tested a single-factor tau-equivalence model, which exhibited poor fit, $\chi^2(135) = 539.65$, $p < .001$; CFI = .71; TLI = .71; RMSEA [90% CI] = .12 [.11, .13]; SRMR = .15. The poor fit was apparent in the standardized covariance residuals matrix, which contained 57 significant residuals out of a possible 153. Modification indices suggested freely estimating factor loadings. Thus, we tested a subsequent model without an equality constraint on factor loadings. Though the second model displayed improved fit, $\Delta\chi^2(16) = 121.62$, $p < .001$, its fit overall was poor, $\chi^2(119) = 414.43$, $p < .001$; CFI = .79; TLI = .76; RMSEA [90% CI] = .11 [.10, .12]; SRMR = .08. A pattern of positive standardized residuals between equal-valence items indicated that the model tended to significantly underpredict the observed covariation between such items. This finding was corroborated by large modification indices that suggested freely estimating unique factor covariances between negatively worded items. Thus, we tested a third single-factor model with freely estimated residual covariances between all negatively worded indicators. The resulting improvement in fit, $\Delta\chi^2(10) = 83.36$, $p < .001$, was not enough to achieve acceptable fit to the data, $\chi^2(109) = 328.69$, $p < .001$; CFI = .85; TLI = .81; RMSEA [90% CI] = .10 [.09, .11]; SRMR = .07. Standardized covariance residuals indicated that the model underestimated the actual covariation among variables, suggesting the presence of multiple correlated factors. Thus, we next used EFA to explore models with multiple factors.

Exploratory Factor Analyses

We conducted EFA with principal axis factoring and oblique promax rotation using the *psych* package (Revelle, 2020). Kaiser's rule suggested four factors (eigenvalues: 6.67, 1.58, 1.36, 1.02), scree plot suggested one or four factors, and parallel analysis with principal components analysis suggested four factors. To prevent over- and underextraction of factors, we conducted EFA for five-, four-, and three-factor models. We considered loadings >.35 to be strong, and we defined cross-loadings as cases where an item displayed two or more strong loadings.

A five-factor model displayed good fit (CFI = .99; TLI = .98; RMSEA [90% CI] = .03 [.00, .05]) and explained 53% of the variance (individual factors explained 6%–17% of the variance). Though the first four factors were easily interpretable and conceptually distinct, Factor 5 had only two strongly loading indicators, and both were similar in theme to those of Factor 4. Factor 5's strongly loading indicators were negatively worded (unlike Factor 4's), suggesting that the different factors emerged based on item wording rather than conceptual differences.

The four-factor model (Table 1) displayed good fit (CFI = .98; TLI = .96; RMSEA [90% CI] = .05 [.03, .06]) and explained 52% of variance in the data. This model showed strengths compared with the five-factor model: each factor explained >10% of the data variance (range 11%–15%; see Table 1), had ≥3 strongly loading indicators, and showed moderate interfactor correlations (.44–.69; see Table 1). Strongly loading items from Factors 4 and 5 of the five-factor model were combined into a single, fourth factor in the four-factor model. Otherwise, the models showed similar structures, except for a cross-loading of Item 8 on Factors 2 and 4 and Item 7 on Factors 1 and 2 in the four-factor model. For better interpretability, we used jackknife methods (Tukey, 1958) to select the primary factor for Items 7 and 8. Over 243 runs, Item 7 loaded more strongly on Factor 2 than Factor 1 ($t = 10.30$, $p < .001$), and Item 8 loaded more strongly on Factor 2 than Factor 4 ($t = 52.56$, $p < .001$). Consequently, we retained both items on Factor 2.

A three-factor model had mostly poor or marginally adequate fit (CFI = .93; TLI = .89; RMSEA [90% CI] = .07 [.06, .09]) and a relatively large number (5) of cross-loading items. Thus, we rejected this solution and ultimately accepted the four-factor model as the final model.

We interpreted the factors in the four-factor model by assessing items with strong loadings on each factor. Factor 1 was named Identification with University (IU), as its four associated items reflected feelings of affiliation and integration with the university as a whole (Vaccaro & Newman, 2016; Ye & Wallace, 2014). Factor 2 was named Social Match (SM), with five strongly loading items reflecting perceived similarity to others on campus (Strayhorn, 2018). Factor 3 was named SA, with three strongly loading items reflecting positive reception from people on campus (Goodenow, 1993). Factor 4, with five strongly loading items reflecting knowledge about how to successfully navigate academia (e.g., how to develop favorable relationships with faculty), was named CC.

Study 2

In Study 2, we tested the latent factor structure derived in Study 1 and its extensions (higher order and bifactor models). We then tested measurement invariance properties, dimensionality, and construct

Table 1
Pattern Matrix, Factor Correlations, Sum of Squared Loadings, and Variance Explained for Four-Factor EFA Model

Item	F1	F2	F3	F4	h^2
2. I feel like an outsider at [school] (R)	**.87**	−.10	.03	.14	.82
6. I feel alienated from [school] (R)	**.71**	−.04	.01	.18	.63
11. I belong at [school]	**.36**	.11	.15	.29	.55
14. I feel comfortable at [school]	**.45**	.11	.23	.11	.56
4. I think in the same way as do people who do well at [school]	−.05	**.84**	−.13	.04	.57
7. I fit in well at [school]	.43	**.45**	.17	−.08	.73
8. I am similar to the kind of people who succeed at [school]	−.05	**.51**	.02	.33	.53
9. I know what kind of people [school] professors are	−.12	**.48**	−.03	.15	.25
17. People at [school] are a lot like me	.25	**.86**	−.09	−.34	.65
1. People at [school] accept me	.21	.08	**.49**	−.01	.48
10. I get along well with people at [school]	.22	−.02	**.68**	−.16	.56
15. People at [school] like me	−.05	−.21	**1.02**	−.05	.71
3. Other people understand more than I do about what is going on at [school] (R)	.14	.00	−.13	**.36**	.15
5. It is a mystery to me how [school] works (R)	.26	−.13	−.11	**.58**	.38
12. I know how to do well at [school]	−.08	.18	.13	**.55**	.51
13. I do not know what I would need to do to make a [school] professor like me (R)	.02	.00	−.02	**.65**	.40
16. If I wanted to, I could potentially do very well at [school]	−.15	.09	.31	**.40**	.35
Factors					
F1	2.53 (15%)	—			
F2	.51	2.27 (13%)	—		
F3	.56	.69	2.08 (12%)	—	
F4	.44	.55	.45	1.93 (11%)	—

Note. EFA = exploratory factor analyses. Standardized factor loadings and communalities are displayed at top. Bolded loadings indicate the factor on which each item was retained in Study 1. F1 = Identification with the University; F2 = Social Match; F3 = Social Acceptance; F4 = Cultural Capital; h^2 = Communality. At the bottom are included factor sum of squared loadings (diagonal entries, no parentheses), variance explained (diagonal, parentheses), and intercorrelations (off-diagonal).

and criterion validity of the final model. We used data from a 2021 Longitudinal Belonging study conducted at a public, predominantly White university in the midwestern United States, enrolling approximately 33,000 undergraduate and 18,000 graduate students in any given year.

Method

Procedure and Participants

In September 2021, researchers emailed student organizations inviting students to participate in a study on patterns of college belonging. Interested students completed an online consent form and survey, which provided the data described below. The study was approved by the university's institutional review board. This study was not preregistered. Study data and analysis codes are available from authors upon request.

The complete dataset contained responses from 419 participants. After excluding participants with no data on the two belongingness measures, our final sample ($N = 413$) had no missingness on those measures. The data represented nontransfer first-year students (25.2%), sophomores (26.6%), juniors (12.8%), seniors (11.4%), transfer students (7.0%), master-level graduate students (7.0%), and doctoral-level graduate students (9.2%). A small proportion of students (0.7%) did not provide their year in school. Participants' average age was 21.1 years ($SD = 3.6$ years). The sample comprised 65.6% cis women and 27.1% cis men. Participants' self-reported race/ethnicity included American Indian/Alaska Native (2.2%), Asian/Pacific Islander (32.7%), biracial/multiracial (6.8%), Black/African American (7.0%), Hispanic/Latinx (12.8%), Middle Eastern/North African (2.4%), White (34.4%), and other (1.0%). Less than 1% of participants did not provide their race/ethnicity. Due to small sizes of many of the race/ethnicity groups, we coded participants into Asian American/Pacific Islander (AAPI; 32.9%) and White (34.4%) racial categories for measurement invariance tests and correlational analyses. Other racial groups were excluded from these analyses but were included in the full-sample CFAs.

Measures

College Belongingness. We assessed college belonging with two different measures. The SSF showed high reliability (α = .90) in this sample. We also measured college belongingness with the PSSM (Goodenow, 1993), using a 5-point Likert scale (higher scores indicated greater levels of belonging). Our sample's reliability of .90 was close to Goodenow's (α = .88; 1993).

Perceived Stress. We used the Perceived Stress Scale–4 (PSS-4; Cohen et al., 1983), a four-item instrument assessing the degree to which situations in one's life are appraised as stressful. Participants responded from 1 (*never*) to 5 (*very often*) to items such as "In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?" We computed a single mean score, with higher scores corresponding to greater perceived stress. Reliability in our sample (α = .70) was close to the first reported value (.72; Cohen et al., 1983).

Satisfaction With Life. The Satisfaction with Life Scale (SWLS; Diener et al., 1985) is a five-item measure assessing life satisfaction. Responses ranged from 1 (*strongly disagree*) to 7 (*strongly agree*) to items such as "I am satisfied with my life." The instrument is scored by computing the mean across items, and higher scores correspond to greater life satisfaction. Diener et al. (1985) reported α = .87, and we computed reliability of .84 in our study.

Sample Size Considerations

A common norm for CFA is to use at least 10 cases per indicator (Kline, 2015), and Monte Carlo studies (Muthén & Muthén, 2002) have shown that relatively small samples are adequate with normally distributed indicators, little missing data, and models with a substantial number of indicators per factor, as is the case in our study. Our own Monte Carlo simulations—adapting Muthén and Muthén's (2002) model—showed our sample size was sufficient to achieve power >.80 for all parameters tested. We used 10,000 replications to ensure stability, and results showed acceptable levels of estimation bias, with coverage values ranging .91–.98 for parameter estimates and all parameter and standard error biases <10% (Muthén & Muthén, 2002).

For multigroup CFA, conventions suggest a minimum of 100 participants per group (Kline, 2015; Wang & Wang, 2012). Criteria put forth by MacCallum et al. (1996, Table 4) suggest a minimum sample of $N = 178$ (89 per subgroup) based on the smallest degrees of freedom in our analyses ($df = 15$). These references suggest that our group sizes were sufficient for multigroup CFA for gender and race, and our own Monte Carlo simulations suggested the same, exhibiting acceptable levels of statistical power and estimation bias.

A priori power analyses indicated that F tests in multiple linear regression with .80 power at $\alpha = .05/9$ (Bonferroni correction accounting for three tests across three demographic categories) require a minimum sample of $n = 130$ to detect large effects ($f^2 = .16$) and $n = 319$ for medium effects ($f^2 = .0625$). Thus, our sample size was sufficient for latent regression analyses.

Results

Descriptive Statistics

The SSF showed multivariate skew and kurtosis ($b_{1,p} = 37.03$, $p < .001$; $b_{2,p} = 403.56$, $p < .001$), though individual items of the SSF did not show considerable univariate skewness (range [−1.1, 0.3]) or kurtosis (range [−0.7, 1.6]). Similarly, the PSSM, PSS-4, and SWLS did not show significant skew or kurtosis (skew = −0.3/0.1/−0.4, kurtosis = 0.5/0.01/−0.3). The correlation matrix, item means, and item standard deviations are presented in Supplemental Tables S5 and S6.

Confirmatory Factor Analysis

We first tested the four-factor model from Study 1, which exhibited poor fit based on most indices, $\chi^2(113) = 271.82$, $p < .001$; CFI = .89; TLI = .87; RMSEA [90% CI] = .08 [.07, .10], SRMR = .07. As suggested by the results of our CFA tests in Study 1, we modified the model to include freely estimated unique factor covariances for negatively worded items. The modified model showed adequate fit, $\chi^2(103) = 218.17$, $p < .001$; RMSEA [90% CI] = .07 [.06, .09]; CFI = .92; TLI = .90; SRMR = .06. Item loadings, factor correlations, and covariances among the unique factors were all positive and statistically significant.

Bifactor and Second-Order Models

After confirming the SSF's factor structure, we tested second-order and bifactor models to assess its essential unidimensionality. In the second-order model, all four factors from the CFA loaded on a higher order belonging factor. In the bifactor model, items loaded on a general factor and their corresponding specific factor, and all factors were orthogonal. Second-order (CFI = .92, TLI = .90, SRMR = .06, RMSEA = .07 [.06, .09]) and bifactor (CFI = .95, TLI = .93, SRMR = .05, RMSEA = .06 [.05, .08]) models both showed adequate to good fit. With superior fit indices and lower Akaike information criterion/Bayesian information criterion values compared with all other models, the bifactor model was adopted as the final model. Figure 1 displays the bifactor model's standardized parameter estimates. All items loaded significantly onto the general belonging factor (SSF-g; loadings ranged .18–.85). Loadings on the specific factors were positive and significant (loadings ranged .24–.74), except for nonsignificant loadings for Item 7 and all indicators of IU.

We computed ancillary bifactor measures to better understand the model-based reliability (Rodriguez et al., 2016a, 2016b). Coefficient omega $\omega = .92$ indicated that 92% of variance in the unit-weighted total score was attributable to factors in this model. Omega hierarchical $\omega_H = 0.82$ showed 82% of the total score variance was attributable to SSF-g. The SSF total score can be considered a reliable measure of general belonging since ω_H is high (>.80). The ω_H for subscales (ω_{HS}) were .08 (IU), .26 (SM), .32 (SA), and .35 (CC). Values of $\omega_{HS} < .50$ suggest the majority of variance of each subscale was unrelated to the specific factor it intended to measure.

To assess if SSF can be represented as a unidimensional construct, we computed explained common variance (ECV) and percent uncontaminated correlations (PUC). A value of .67 for ECV indicated SSF-g explains 67% of the common variance extracted, near the threshold (.70) to guide the decision to fit a unidimensional model to multidimensional data (Rodriguez et al., 2016a). We also computed PUC, a measure of potential bias when forcing a unidimensional model to multidimensional data, since ECV values become less important with high PUC (>.70; Reise et al., 2013; Rodriguez et al., 2016a). Rodriguez et al. (2016a) note that with high PUC, relative bias can be small even with ECV as low as .50. Our PUC value (0.79) suggests relative biases were slight and that a unidimensional model may suffice to measure general belonging.

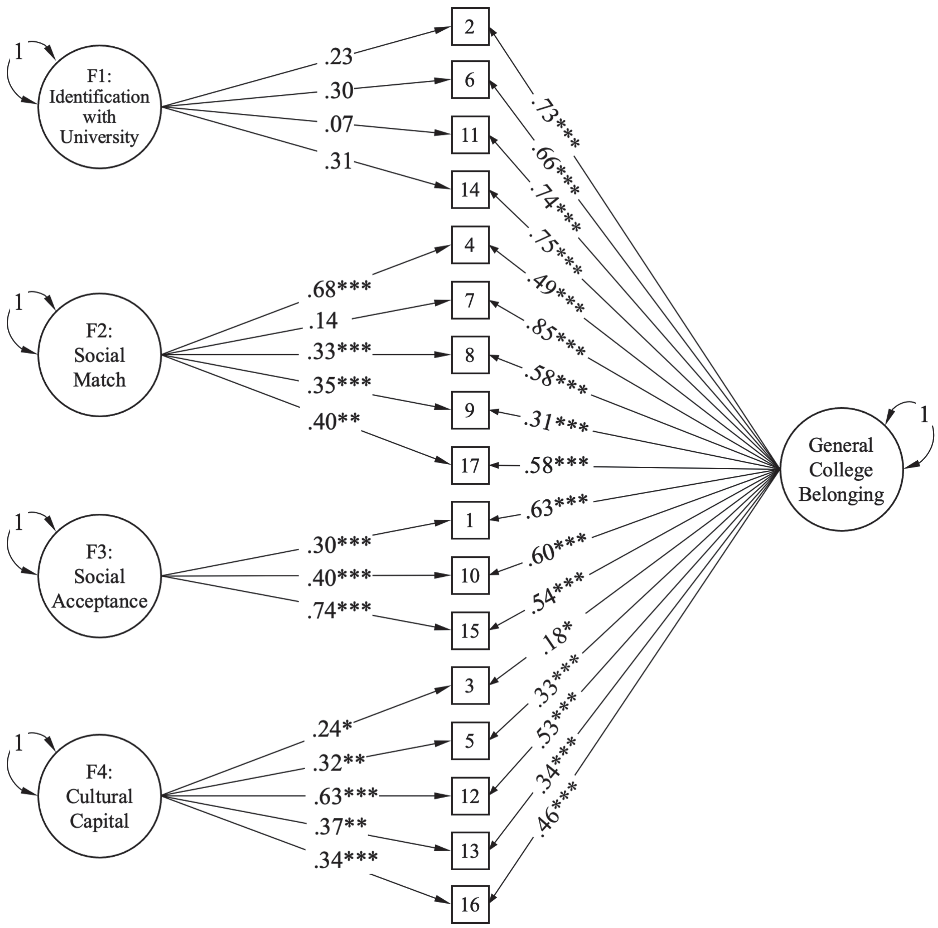
Finally, item-level ECV (I-ECV; Rodriguez et al., 2016b) values ranged 0.34–0.99 (mean = .65), with six items having values above .80 (Items 1, 7 and all indicators of IU). The I-ECV values of IU indicators had an average value of .90, suggesting that these items are relatively pure measures of general belonging. Taken together, the CFA and ancillary tests above indicate our data is best depicted by a bifactor model with a strong total score factor.

Measurement Invariance

We assessed measurement invariance separately for race and gender. We sequentially increased the level of constraints (in order: configural, metric, scalar, strict). At each step, a value of $|\Delta CFI| > .01$ or significant $\Delta\chi^2$ between adjacent models would indicate noninvariance (Brown, 2015; Chen, 2007). We report here the highest level of invariance achieved. Detailed results for all tested models are provided in Table 2. For gender, subgroup sizes limited invariance tests to only cis men/women. Separate bifactor CFAs for each group showed good fit, and multigroup CFAs showed the model achieved strict invariance. For analysis across race, separate bifactor CFAs indicated good fit for AAPI and White students. Subsequent multigroup CFA showed the model achieved strict invariance across these groups.

Figure 1

Results of Study 2 CFA Test of Bifactor Model of Sense of Social Fit Scale With Standardized Parameter Estimates



Note. CFA = confirmatory factor analyses.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Comparing Latent Means

Because the bifactor model showed strict invariance across race and gender, we compared latent means on SSF-g and the four specific factors across groups. Based on the literature, we expected greater self-reported belongingness among White students than AAPI students and equal levels between cis men and women. Using constrained multi-group CFAs corresponding to the level of measurement invariance for each demographic category, we found significant differences in mean scores across race but not gender. White students reported greater levels of CC than AAPI students (difference = .77, $p < .001$). Latent means for the general factor and the other three specific factors were not statistically different between groups (see Table 3).

Criterion and Concurrent Validity

We conducted a series of latent regression analyses to test the criterion and concurrent validity of the general and specific factors of SSF. Using the PSSM as a criterion measure, we regressed PSSM on SSF-g and the four specific factors across groups in a structural equation modeling framework. Since the general and specific factors were orthogonal, their path coefficients represented their unique contributions in predicting a criterion measure. We carried out the same procedures with scores on the PSS-4 and SWLS to test associations between SSF-g and specific factors and these related constructs. Since we conducted three sets of tests across three nonorthogonal demographic categories (full sample, gender, race), we used a Bonferroni-corrected significance level of .05/9.

Since PSSM and SSF have similar theoretical underpinnings, we expected SSF-g to positively and strongly predict PSSM scores. Research with other college belonging measures shows large correlations (.48) with life satisfaction (Duffy et al., 2020), so we hypothesized a strong positive relationship between SSF-g and SWLS. Last, Grobecker (2016) reported a correlation of −.28 between school belonging and a longer version of the stress instrument used in our study; we hypothesized SSF-g would show a moderate negative association with PSS-4. Because the present study is the first to use a bifactor model of college belonging, we did not make hypotheses about relationships between the specific factors and the measures above.

Table 2
Summary of Fit Indices for Tests of Measurement Invariance of the Bifactor Model

Model	χ^2	*df*	RMSEA [90%CI]	CFI	TLI	SRMR	$\Delta\chi^2$	Δdf	ΔCFI	MI
				Race (AAPI, White)						
Configural	331.18***	184	.07 [.06, .09]	.93	.90	.05				Y
Metric	348.82***	213	.06 [.04, .07]	.95	.93	.06	13.07	29	.011	Y
Scalar	359.45***	225	.06 [.04, .07]	.95	.94	.06	9.61	12	.001	Y
Strict	398.14***	242	.06 [.04, .07]	.94	.93	.07	26.00	17	−.007	Y
				Gender (men, women)						
Configural	305.83***	184	.05 [.04, .07]	.96	.94	.05				Y
Metric	348.55***	213	.05 [.04, .06]	.96	.94	.06	38.69	29	−.004	Y
Scalar	359.27***	225	.05 [.04, .06]	.96	.95	.06	12.16	12	.000	Y
Strict	402.76***	242	.05 [.04, .06]	.95	.95	.06	20.58	17	−.003	Y

Note. MI = measurement invariance (yes/no); AAPI = Asian American/Pacific Islander; RMSEA = root-mean-square error of approximation; CFI = comparative fit index; TLI = Tucker–Lewis index; SRMR = standardized root-mean-squared residual. All $\Delta\chi^2$ tests were non-significant.
*** $p < .001$.

Standardized regression coefficients for PSSM scores were positive and significant for all groups (range .87–.92; see Table 4). The coefficients of specific factors were mostly nonsignificant, with two exceptions. The IU and SM factors significantly predicted PSSM scores for cis men beyond the general belonging factor ($b = .22$ and .21, respectively). Similar patterns were found for coefficients with PSS-4 and SWLS: SSF-g significantly predicted PSS-4 and SWLS scores in the expected directions and magnitudes, and specific factors explained little variance beyond the general factor. We note two exceptions: IU significantly predicted PSS-4 among cis women ($b = -.22$) and CC significantly predicted SWLS in the full sample ($b = -.12$).

Discussion

In this article, we sought to understand the factor structure, measurement invariance properties, and concurrent and criterion validity of the SSF. To our knowledge, ours is the first study to systematically explore the factor structure and measurement invariance of this scale. The original scale developers proposed a one-factor structure for the measure, though their study used a small sample and did not provide details about the model fit or the suitability of their data for factor analysis (Walton & Cohen, 2007). Single-factor models tested in Study 1 showed poor fit to our data, and modification indices applied liberally to the single-factor model were not enough to achieve acceptable fit. Modification indices, however, are most likely to yield successful results when the unmodified model already closely approximates population characteristics (MacCallum, 1986). Thus, a single-factor model of the SSF proved too simplistic, and our results suggested that a multifactor model might better describe this measure.

In subsequent EFA procedures, we derived a four-factor model with correlated factors comprising Identification with the University, Social Match, SA, and CC. The IU factor reflected a sense of affiliation with the university as a whole; SM dealt with perceived similarity to others at school; SA involved feelings of acceptance and getting along with others at school; and CC tapped into having knowledge about how to successfully navigate academia. The four-factor model corroborates others' findings that college belonging is a multidimensional construct (e.g., Tovar & Simon, 2010). Moreover, our findings provide a more granular perspective of college belonging than how the SSF is currently used.

Study 2 CFAs showed adequate fit for Study 1's four-factor model with freely estimated residual covariances between reverse-scored items. We also tested second-order and bifactor models. By all accounts, the bifactor model, with one general factor and four specific factors (Figure 1), showed superior fit to all other models. We adopted this model as the final model in our studies. Ancillary analyses with the bifactor model in Study 2 suggested that researchers should score the SSF by computing an average score from all 17 items.

Multigroup CFA provided evidence for the measure's strict invariance for AAPI and White students and cis men and women. Our findings provide psychometric support for making comparisons between these groups on regression coefficients and latent mean

Table 3
Comparisons of Sense of Social Fit Latent Factor Means Across Demographic Groups

Variable	SSF-g	Identification with university	Social match	Social acceptance	Cultural capital
Race (RG = AAPI)					
White	.10	.08	.31	.10	.77***
Gender (RG = women)					
Men	−.11	.20	.06	.07	−.04

Note. Standardized means are presented. RG = reference group, whose latent means were set to zero for comparisons; AAPI = Asian American/Pacific Islander; SSF-g = general factor of bifactor model of Sense of Social Fit scale; SSF = Sense of Social Fit.
*** $p < .001$.

Table 4
Standardized Regression Coefficients With Criterion and Related Measures

SSF factors	Full sample	Race: AAPI	Race: White	Gender: Men	Gender: Women
		Coefficients for regression with PSSM			
SSF-g	**.88**	**.90**	**.91**	**.87**	**.92**
F1: Identification with University	.40	.13	.30	**.22**	.08
F2: Social Match	**.22**	.21	.16	**.21**	.15
F3: Social Acceptance	.11	.13	.08	.11	.03
F4: Cultural Capital	.04	−.01	−.04	.12	.55
		Coefficients for regression with PSS-4			
SSF-g	**−.33**	**−.26**	**−.50**	**−.42**	**−.32**
F1: Identification with University	−.31	.09	−.11	−.10	−.32
F2: Social Match	**−.22**	−.47	.01	−.08	**−.25**
F3: Social Acceptance	−.08	−.07	−.28	−.21	−.06
F4: Cultural Capital	.08	.35	−.00	−.05	−.04
		Coefficients for regression with SWLS			
SSF-g	**.49**	**.51**	**.53**	**.51**	**.44**
F1: Identification with University	−.20	−.13	−.20	−.11	.23
F2: Social Match	.09	.18	−.04	.13	.09
F3: Social Acceptance	.06	.21	−.01	.15	.15
F4: Cultural Capital	**−.12**	−.56	−.07	−.18	.07

Note. SSF-g = general factor of bifactor model of Sense of Social Fit scale; SSF = Sense of Social Fit; AAPI = Asian American/Pacific Islander; PSSM = Psychological Sense of School Membership; PSS-4 = Perceived Stress Scale–4; SWLS = Satisfaction with Life Scale. Since three sets of regression coefficients were tested and each participant was included in three groups (full sample, race, gender subgroups), we used a Bonferroni correction (.05/9). Statistically significant coefficients ($p < .006$) are bolded.

scores on the SSF general and specific factors. In our latent mean comparisons, as hypothesized, cis men and women reported similar mean levels of belonging. Though there were no significant differences on SSF-g, White students scored .77 *SD*s higher than AAPI students on CC. The latter finding corroborates what education scholars have noted about PWIs, namely that these institutions privilege the CC of White affluent students over that of other students, particularly racially minoritized students (Strayhorn, 2018; Yosso, 2005). The nonsignificant differences in other specific factors might reflect the study's context, where AAPI students constitute >20% of the student body and have access to resources such as cultural houses, student organizations, and affinity-based counseling groups. These resources facilitate spaces that support the social factors of belonging (i.e., social match and SA) without necessarily addressing CC barriers to belonging at a PWI.

Structural regression analyses further established the validity of the bifactor model. Supporting our hypotheses and providing evidence of criterion validity, we found that SSF-g significantly and strongly predicted PSSM scores for the full sample and all observed subgroups. The analyses also showed a small but significant association between IU and PSSM for cis men, and between SM and PSSM for the full sample and cis men. This suggests that for cis men, there might exist a small effect of these two factors on sense of school membership, independent of one's sense of general belonging. We note that analyses of the subscales were exploratory in nature, and our main takeaways concern the hypothesized regression coefficients of SSF-g.

Regression analyses with PSS-4 and SWLS provided support for the concurrent validity of the SSF. Supporting our hypotheses, SSF-g showed small-to-medium (negative) associations with PSS-4 and medium-to-large (positive) associations with SWLS. Our results corroborate those of social belonging intervention studies that show a causal relationship between college belonging, perceived stress (Walton et al., 2015), and life satisfaction (Brady et al., 2020).

Interestingly, the CC-specific factor showed a small negative correlation with SWLS for the full sample. The effect appears to be driven by AAPI students, though the effect in this subgroup was marginally nonsignificant with our Bonferroni correction ($\beta = -.56$, $p = .01$; for White students, $\beta = -.07$, $p = .62$). Our results are concordant with education scholars' understanding of the significance of CC for racially–ethnically minoritized students. Strayhorn (2018) discusses how PWI value and reward the types of CC inherited by White students rather than those of racially–ethnically minoritized students. Unlike their White peers, racially–ethnically minoritized students are forced into a taxing "second curriculum" (p. 48) of attaining the types of CC that are privileged at PWIs. Our data show evidence consistent with this argument. Evidently, this attainment of CC—outside its relevance to college belonging—can carry negative consequences for life satisfaction, perhaps especially so for racially minoritized students.

Implications

This study has implications for conceptualization and measurement of college belonging. As noted in the introduction, researchers' views differ on whether CC is a component of college belonging or a distinct but related construct. The emergence of the CC factor in our analyses lends support to the former view. Still, loadings of CC items on SSF-g, though all positive and significant, were weaker than those of other items. Future research should further test the validity of CC as a factor of college belonging, in particular considering for whom and under what circumstances CC might be a valid factor (e.g., Fernández et al., 2023).

Our model provides a nuanced understanding of belongingness and its salience for students. Latent mean comparisons showed AAPI students exhibited lower levels of CC than White peers, and regression analyses suggested that attaining the CC that is rewarded at a PWI may incur costs for life satisfaction, particularly for AAPI students. As noted by others, attainment of this CC may both be especially relevant for minoritized students in developing a sense of belonging (Fernández et al., 2023) and pose an additional burden for minoritized students (e.g., Isserles & Dalmage, 2000; Strayhorn, 2010, 2018). Scholars have posited, in fact, that developing a sense of belonging within structurally racist institutions may not be a wholly positive thing, even if it is positively associated with academic attainment (Stokes, 2023). Our findings suggest that clinicians, administrators, and educators wanting to address belonging needs of AAPI students should pay particular attention to CC, and belonging interventions should target systems and institutions so that they value and reward the CC and cultural wealth of minoritized students (Garriott, 2020; Yosso, 2005).

Based on our results, we recommend researchers scoring the SSF to include all 17 items and compute a total scale score. Additionally, researchers can use the bifactor model with specific factors in an structural equation modeling framework. We note that our results do not currently support individual scoring of subscales. Because the IU indicators loaded strongly and exclusively on the general factor in the bifactor model and displayed high I-ECVs, our results provide preliminary evidence that these items may form the basis for developing a brief version of the SSF (Rodriguez et al., 2016b). More research is needed, however, before recommending a brief version of the SSF. Additionally, our tests of measurement invariance provide evidence supporting the use of SSF for comparisons (of slopes, correlations, and mean scores) between different groups, specifically cis men/women and White/AAPI students.

Limitations and Future Directions

Building on our findings, we encourage future studies with college student samples from minority-serving institutions (e.g., historically Black colleges and universities, tribal colleges and universities, and Hispanic serving institutions). Such studies will increase our ability to identify systems-level factors that may influence the measure's psychometric properties among culturally diverse college students. Additionally, we may or may not find the same four-factor structure in community colleges or commuter colleges, whose structures, expectations, and cultural climates differ from those of 4-year institutions. It is also important to consider further strengthening the existing measure via scale development that utilizes qualitative methods that can capture nuances of college belonging (Vaccaro & Newman, 2016). Pursuing this research may strengthen the validity and reliability of this widely used measure, leading to culturally responsive utilization and accurate interpretation of findings.

This study had a number of limitations. Although we provided hypotheses and tests of the validity of the SSF's general belonging factor, our analysis of subscales was exploratory in nature. We hope our results provide an empirical basis for future work on the validity of the SSF, with particular attention to the specific factors derived here. Additionally, small subgroup sizes limited our multigroup analyses of race (to AAPI/White) and gender (to cis women/men) and precluded analyses of Measurement Invariance across generation status. There remains a need for future work testing the validity of our model with other racial–ethnic groups, genders, and first-generation students and applying an intersectional lens. The Study 2 sample included graduate students to ensure that statistical tests were sufficiently powered, though subgroup sizes prevented us from testing class standing as a demographic factor. While some theories of school belonging posit differences between graduate student and undergraduate student belonging (Strayhorn, 2018), empirical studies have established the validity of college belonging measures for use with a diverse range of graduate students (Drezner & Pizmony-Levy, 2021; Holloway-Friesen, 2021). Nevertheless, future studies of the SSF should be conducted with graduate students to confirm the structure described here. Last, the reduced statistical power due to Bonferroni corrections limited our ability to interpret the relationship between the CC-specific factor and SWLS in our regression analysis. We encourage researchers to further test relationships among CC, general college belonging, and life satisfaction, especially among minoritized students.

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