# A Systematic Review of Instruments Measuring College Students' Sense of Belonging

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## Background

This research paper endeavors to review the various instruments developed to measure the sense of belonging among college students. College students' sense of belonging (SB) has been identified as a critical contributor to their persistence, academic success, and professional identity [1]. However, the complexity of the SB construct, which has been variously defined in the literature, presents difficulties for researchers in choosing an instrument that fits their research needs. For example, Goodenow [2, p. 25] defines SB as "being accepted, valued, included, and encouraged by others (teacher and peers) in the academic classroom setting and of feeling oneself to be an important part of the life and activity of the class". This definition presents SB as a unidimensional construct, which can be measured as a general SB. Alternatively, Freeman et al. [3] view SB as a multidimensional construct encompassing class belonging, university belonging, professors' pedagogical caring, and social acceptance, suggesting that measuring SB should be approached by asking questions that correspond to each of these dimensions. Given the diversity of conceptual definitions of SB, it is reasonable to anticipate the presence of multiple measurement instruments for this construct. For example, Goodenow's Psychological Sense of School Membership [PSSM] was created to measure a general SB, while William et al.'s Higher Education Belonging Scale [HEBS] was created to measure multifaced SB. With the multitude of instruments available, it can be challenging for engineering education researchers to choose the one that best fits their research needs. To our knowledge, little research has been done to synthesize the information on instruments for measuring college students' SB.

The purpose of this review study is to comprehensively summarize information on the features of existing SB measurement instruments used in higher education. This review study begins with a comprehensive overview of the different conceptual definitions of SB and their corresponding theoretical foundations in the context of higher education. In the Methods section, the study outlines the methodology used for identifying the existing SB measurement instruments used in higher education. The Results section then presents the findings of the review, including the information on the psychometric properties of the identified SB measurement instruments, as determined by previous research on instrument development. The outcome of this review offers guidance on how to measure SB effectively and assists engineering education researchers in selecting the most appropriate instrument for their research given their specific research topic and context.

## Conceptual Definition of Sense of Belonging

A few theorists have claimed that SB is a basic human need [4, 5], and, according to many researchers, it promotes social and academic success in the college setting [3, 6]. The concept of belongingness was first explored as part of Maslow's [5] hierarchy of needs, an important concept that shaped psychological research. Maslow established the "need for love and belonging" as one of five needs in his model, noting that humans have a strong natural desire to be part of a group and to enjoy affectionate relationships. In addition, belonging affects the

achievement of esteem and the fulfillment of self-actualization. Furthermore, the process and mechanism of the fulfillment of these needs across populations are determined by contexts and experiences. Therefore, Maslow defined belonging as a basic human need, which he described as a hunger for affectionate relations—specifically, a desire for membership in a group—and great efforts to fulfill this desire will be exerted [5, p. 381]. As with the other psychological theories and constructs, the concept of belonging is based on Maslow's hierarchy of needs [6].

Later, Baumeister and Leary [4] broadened the construct of belonging with the belongingness hypothesis. They defined belonging as a factor in developing and maintaining lasting, positive, and meaningful interpersonal bonds. Furthermore, this hypothesis is supported by two characteristics: (a) that individuals maintain conflict-free interaction with others and (b) that individuals retain connections with others through stable, committed, and genuine concern. By developing long-term relationships, a person can satisfy their need for SB. According to this hypothesis, the need for belonging can be met by a combination of positive interactions or a constant relationship [4]. Students' behavior, intentions, or motivations have been largely analyzed using this belongingness hypothesis in educational research [7]. Both Maslow [5] and Baumeister and Leary [4] emphasize that a person must have SB to create a high desire for knowledge.

As part of students' social and academic integration, SB has been introduced into education [8, 9] and as an indicator of the degree of inclusion. Spady's [8] Undergraduate Dropout Process Model was particularly interesting as it defined social integration as a student's perception of their sense of belonging, whether they felt they "fit in" on campus and the warmth of students' interpersonal relationships. On the other hand, Tinto's " Model of Institutional Departure" focuses on the importance of SB for higher education students, demonstrating that social integration is important to prevent student attrition. Students need integration into formal (academic performance) and informal (faculty/staff interactions) academic systems and formal (extracurricular activities) and informal (peer-group interactions) social systems [9]. Tinto describes SB as a generalized sense of membership that stems from students "perception of their involvement in a variety of settings and the support they experience from those around them" [10, p. 66]. The foundation of his model is derived from the difficulties that postsecondary students face during their pursuit of higher education. It has been a widely used framework for studying and researching students' transition and integration into college. However, Tinto's theory is also critiqued as it does not include cultural factors and the sense of isolation and discrimination encountered by racial and ethnic minority groups in the process of transition and integration [11].

Recently, Stray's [12] model of college students' sense of belonging gain a more comprehensive understanding of the concept. According to Strayhorn's model, SB comprises seven essential components. These include the basic human need for belonging, which is a fundamental motivator for behavior. Additionally, the context, time, and circumstances surrounding one's sense of belonging are crucial factors. Feeling valued and appreciated by others and the influence of one's identity are also important factors. SB leads to positive outcomes such as achievement, engagement, and happiness. It is a continuous process that changes as circumstances change. This model is closely related to Maslow's model of basic human needs. According to Maslow's hierarchy of needs, physiological needs must first be met,

followed by social needs such as belongingness and esteem. The absence of SB can impede the development of higher-order needs such as creativity, innovation, and knowledge. Therefore, it is crucial to satisfy the need for SB before any interest in involvement can be developed.

Overall, the concept of SB is still evolving because it has a temporal nature that changes with the specific context. Individual students' SB varies according to their current environment: Students with a high SB in a particular educational setting may have a low SB if they enter a different educational setting. Consequently, SB is complex and operationalized in conflicting ways. Various scholars agree that belonging is vital for students and schools, but the literature does not consistently define and operationalize belonging across theoretical frameworks. Despite these methodological inconsistencies, researchers have developed many quantitative measures to measure SB. The following section summarizes the most commonly used SB measurement instruments in higher education.

## Methodology

The current research is a systematic review. Systematic literature reviews aim to reduce bias by using explicit methods to perform a comprehensive literature search and critically appraise individual studies [13]. The process involves performing the literature search and applying specific inclusion and exclusion criteria to identify existing SB measurement instruments and their psychometric properties in higher education. Many related constructs in the literature use analogous terminologies and scales to represent SB, such as connectedness, attachment, relatedness, school bonding, and membership [14]. This study mainly focuses on measurement tools rather than various terms used to describe SB. Additionally, since a large number of instruments and scales are used to measure SB according to the specific goals or needs, we limited our review to studies that specifically used psychometric measures. They were validated on instrument development for assessing SB in higher education.

### *Selection Criteria*

The systematic review included peer-reviewed articles that: (1) focused on empirical studies involving quantitative scale development or modification (e.g., changing the wording) and validation, as we aimed to determine how researchers ensured the reliability and validity of the instruments; (2) featured literature with participants who were college students in higher education. Studies were excluded if they: (1) did not generally provide details on how measurements were developed, such as in conference abstracts, editorial materials, and news; (2) were not aimed at publishing SB scale goals.

### *Search Strategy*

To gather articles for this literature review, EBSCO databases (e.g., PsycINFO, ERIC, JSTOR Journals, MEDLINE, Supplemental Index, Health and Psychosocial Instruments, etc.) were queried through the university's library search for the current draft paper. The main search terms were based on a combination of keywords such as *sense of belonging, instrument, and higher education*, yielding the following general search block: ("sense of belonging" OR "belongingness" OR "connectedness" OR "relatedness") And ("tool" OR "instrument" OR

"scale" OR "questionnaire" OR "measurement" OR "assessment") And ("higher education" OR "college" OR "university" OR "post-secondary" OR "postsecondary"). Since the focus was on peer-reviewed studies, gray literature, such as news and conference abstracts, was excluded. Table 1 presents the search results for each set of terms used across various search fields.

**Table 1**

*Search Term Results*

| Search Terms | First time Search Field | Second time Search Field | Third time Search Field | Fourth time Search Field | Total |
|---|---|---|---|---|---|
| ("sense of belonging" OR "belongingness" OR "connectedness" OR "relatedness") | AB Abstract | TI Title | TI Title | TI Title | - |
| ("tool" OR "instrument" OR "scale" OR "questionnaire" OR "measurement" OR "assessment") | AB Abstract | AB Abstract | TI Title | TI Title | - |
| ("higher education" OR "college" OR "university" OR "post-secondary" OR "postsecondary") | AB Abstract | AB Abstract | AB Abstract | TI Title | - |
| Initial Results | 3889 | 737 | 123 | 89 | 4845 |
| Results After Filters (Full text, Peer-Reviewed, 1993-2023, English) | 1843 | 394 | 21 | 5 | 2263 |
| # of articles after duplicate records removed | 1435 | 301 | 10 | 4 | 1750 |
| # of articles pulled based on the selection criteria (empirical study, original quantitative study, college students) | 10 | 19 | 6 | 2 | 37 |
| # of final articles pulled based on the excluded criteria (not provide details on measurements, not aim at SB scale) | 2 | 6 | 2 | 0 | 10 |

*Note.* According to EBSCO Discovery Service (EDS) codes: TI Title means "searches keywords in a record's English and non-English title field"; AB Abstract means "performs a keyword search of the abstract summaries."

To ensure the relevance of the articles, we used combinations of fields "TI Titles" and "AB Abstract," which means the keywords should appear in the titles or abstracts once selected [15]. Our initial queries employed search terms from "AB Abstract" in EBSCO, yielding 3,889 articles. We then narrowed down these articles using four filters: scholarly (peer-reviewed) journal, full-text available, a date range of 1993 to the present, and English. Applying these filters resulted in 1,843 articles sorted by relevance. Two independent authors screened the literature for cross-checking. After removing duplicate research studies, we reviewed the titles and abstracts of these articles using the search criteria mentioned above. If the articles' relevance could not be determined from the title and abstract, we read the full articles for further evaluation. Disagreements between individual judgments were resolved through discussion among all authors. For the second search, we changed the fields to a combination of "TI Titles" and "AB Abstract." In total, we identified 10 significant empirical studies focused on developing original SB instrument scales in higher education, based on the above retrieval process and search criteria shown in Table 1. We used descriptive data to categorize these articles based on the instruments they employed.

## Results

In the analysis of the 10 selected articles, it was observed that the sample sizes of participants varied considerably, ranging from 205 (Instrument #3)[6] to 4,851(Instrument #10) [19] individuals. The ages of participants spanned from 17 (#1, 7) to 72 (#2) years. A notable trend among eight of the studies was the predominance of female participants over their male counterparts. The studies encompassed participants from diverse racial and ethnic backgrounds, all of whom were undergraduates representing various institutions. Despite this diversity, it is important to note that only a limited number of studies specifically targeted students from particular majors, such as those pursuing STEM fields. Comprehensive information regarding the sample sizes of participants can be found in Appendix A.

### *Unidimensional Instruments*

Among the 10 studies included in this research, two employ unidimensional instruments. The first one is the Need to Belong Scale (NTBS) developed by Leary et al. (1995), which was grounded on Baumeister and Leary's (1995) Belongingness Hypothesis aimed at elucidating human behavior. The researchers crafted a self-reported measure to assess the desire for acceptance and belonging using a 5-point scale with 10 items to scrutinize social belonging and individuals' reactions to potential acceptance or rejection. The second unidimensional instrument is Lingat’s (2014) Simple University Belonging Scale (SUBS), which amalgamated Tinto's (1975) framework and social cognitive theory (SCT) [16]. Tinto's (1975) framework underscored concerns relating to retention, referring to the persistent enrollment and integration of students in postsecondary institutions. SCT bridges the behavioral factors of student achievement, i.e., retention, and personal factors, i.e., sense of belonging, within the environmental context of a specific academic level, i.e., postsecondary or higher education. This instrument adopted Whiting et al.'s (2009) [17] Simple School Belonging Scale (SSBS), a prevalent unidimensional scale used to measure K-12 students. The researchers replaced the term "school" with "university," "class," or the name of the university in the items, constructing a 10-item instrument that employs a 4-point Likert scale to investigate students' university belonging.

### *Multidimensional Instruments*

In our review of 10 studies, eight of them employed multidimensional instruments. Among these eight studies, Hoffman et al.'s (2002) and Freeman et al.'s (2007) instruments were based on Tinto's model of student integration. Freeman et al. (2007) also drew on Goodenow's (1993) Psychological Sense of School Membership (PSSM) scale, as did Wilson and Gore (2013). The remaining five studies were guided by different theories, depending on their research designs. Furthermore, Freeman et al. (2007) and Wilson and Gore (2013) are two of the eight studies that attempted to adapt existing and well-established instruments to measure SB in higher education. Freeman et al. (2007) studied SB in first-year college students at the classroom and campus levels, using Tinto's (1975) student integration model (i.e., academic and social integration) as a guide, and adapting Goodenow's PSSM to the university level. The adapted PSSM instrument includes measures of class belonging, university belonging, professors' pedagogical caring, and social acceptance. Wilson and Gore (2013) developed a conceptual framework comprising three components: insecure attachment styles, university perceptions, and connectedness. They adapted Hoffman et al.'s SOBS and PSSM scales to investigate the role of parental and peer attachment as distal predictors of undergraduate students' SB. The remaining six studies developed dependable and valid instruments to assess SB in the context of higher education. For example, Hoffman et al. (2002) developed the Sense of Belongingness Scale (SOBS) based on Tinto's (1975) theoretical framework. The instrument includes two components, student/peer relationships and student/faculty relationships, which are multidimensional measures of SB. Table 2 provides further details.

Earlier studies on SB measured it based on the general human need for belonging [6, 18]. According to this perspective, interactions with others in an environment of care and concern can fulfill one's need for belonging [4]. Many studies on SB in higher education propose two constructs: social belonging and academic belonging [3, 6, 1]. More recent studies on SB in higher education have expanded the construct to include institutional commitment, which is closely related to faculty interaction [6, 21]. Table 2 shows that most components were designed to measure social belonging (Instruments #1, 2, 3, 4, 8, 9) and academic belonging (#3, 6, 7, 8, 9). Some researchers added general and institutional components to measure SB in higher education. General belonging (#2, 3, 9) appeared in many SB studies, but not consistently in the context of higher education. Institutional belonging (#6, 8) has increasingly been examined in research on SB in higher education over the past two decades. The choice of constructs depended on the significant instruments created and developed for use in higher education. For instance, Malone et al. (2013) relied on Baumeister and Leary's (1995) belongingness hypothesis to develop the General Belongingness Scale (GBS), which was designed to measure a central construct: belongingness. The GBS includes two components to measure social belonging: acceptance/inclusion and rejection/exclusion. Hagerty et al. (1992) developed the Sense of Belonging Instrument (SOBI) to assess both general and social SB, concerning valued involvement, fit, and antecedents to belonging. Hence, they developed the Sense of Belonging Instrument (SOBI) with two subscales, SOBI-P (psychological experience-fit and valued involvement) and SOBI-A (antecedents). Furthermore, Hoffman et al. [6] used the Sense of Belongingness Scale (SOBS) to measure general, social, and academic belonging. The researchers utilized measures of peer support, isolation, classroom comfort, faculty support/comfort, and empathetic faculty understanding correspondingly.

**Table 2**

*Summary of the Existing Literature on Measurement Instruments for Sense of Belonging Framework and Components*

| No. | Source | Theoretical/Conceptual Framework | General | Social | Academic | Institutional |
|---|---|---|---|---|---|---|
| 1 | Lee and Robbins's (1995) The Social Connectedness and the Social Assurance | Kohut's (1984) Self Psychology Theory | | Companionship involving one-on-one contact; Affiliation with small groups; Connectedness to a grander social context | | |
| 2 | Hagerty et al.'s (1996) Sense of Belonging Instrument (SOBI) | Hagerty et al. (1992) theoretical frameworks, described as (1) psychological, social, spiritual, or physical involvement; (2) attribution of meaningfulness to that involvement; and (3) establishment or fortification of a fundamental foundation for emotional, cognitive, and behavioral responses | Psychological, social, spiritual, or physical involvement | Social acceptance; Social assurance | | |
| 3 | Hoffman et al.'s (2002) The Sense of Belongingness Scale (SOBS) | Tinto's (1993) Student Integration Theory and Astin's (1984) Student Involvement Theory. The conceptual framework includes two components: Student/peer relationships; Student/faculty relationships. | Perceived classroom comfort; Perceived isolation | Perceived peer support | Perceived faculty support/comfort; Empathetic faculty understanding. | |
| 4 | Malone et al.'s (2012) The General Belongingness Scale (GBS) | Baumeister and Leary's (1995) Belongingness Hypothesis | | Acceptance; Rejection | | |
| 5 | Leary et al.'s (2013) Need to Belong Scale (NTBS) | Baumeister and Leary's (1995) Belongingness Hypothesis (Unidimensionality) | | Social acceptance | | |

**Table 2**
*Continued*

| | | | | | | |
|---|---|---|---|---|---|---|
| 6 | Slaten et al.'s (2018) The University Belonging Questionnaire (UBQ) | Based on Slaten et al.'s (2016) study, the conceptual framework includes four components: valued group involvement, intrapersonal factors, meaningful personal relationships, and environmental factors. | | | Faculty and staff relations | University affiliation; University support and acceptance |
| 7 | Williams et al.'s (2018) The Higher Education Belonging Scale (HEBS) | Maslow's (1970) Hierarchy of Needs and Ryan and Deci's (2020) Self Determination Theory<br>The conceptual framework includes three components: social aspects of belonging, identification with a group, and safety needs. | | | Social connectedness; Social assurance | |
| 8 | Freeman et al. (2007) - Adaptations of the PSSM | Tinto's (1987) Academic and Social Integration Model and Goodenow's (1993) PSSM Scale | | Social acceptance | Class belonging; Professors' pedagogical caring | University belonging |
| 9 | Wilson and Gore (2013)- Adaptations of the SOBS and PSSM | Goodenow's (1993) PSSM Scale<br>The conceptual framework includes three components: insecure attachment styles, university perceptions, and connectedness | Perceived classroom comfort; Perceived isolation | Perceived peer support | Perceived faculty support/comfort; Empathetic faculty understanding. | |
| 10 | Lingat (2020) - Adaptations of the SSBS to create a Simple University Belonging Scale (SUBS) | Tinto's (1993) Student Integration Model (Unidimensionality) | | | | University belonging |

**Table 3**

*Summary of the Existing Literature on Measurement Instruments Scales and Psychometric Properties for Sense of Belonging*

| No. | Source | Instrument (Abbreviation) | Number of Items | Corresponding Response Options | Reliability | Validity |
|---|---|---|---|---|---|---|
| 1 | Lee and Robbins (1995) | The Social Connectedness and the Social Assurance Scales | 16 | 6-point Likert Scale, ranging from strongly agree (1) to strongly disagree (6) | **Internal consistency reliability**: α = 0.91 and 0.82. **Test-retest c**: α = 0.96 and 0.84. | **Construct Validity**: CFA. |
| 2 | Hagerty et al. (1996) | Sense of Belonging Instrument (SOBI) | SOBI-P: 18 SOBI-A: 9 | 4-point Likert Scale, ranging from strongly agree (1) to strongly disagree (4) | **Internal consistency reliability:** SOBI-P α = 0.93, 0.93, and 0.91; SOBI-A α = 0 .72, 0.63, and 0.76, respectively. **Test-retest reliability:** SOBI-P α = 0.84 and SOBI-A α = 0.66. | **Construct Validity:** Factor analysis, contrasted groups, and comparison with other measures. |
| 3 | Hoffman et al. (2002) | The Sense of Belongingness Scale (SOBS) | 26 | 5-point Likert Scale: Completely True (1); Mostly True (2); Equally True and Untrue (3); Mostly Untrue (4); and Completely Untrue (5) | **Internal consistency reliability:** α = 0.91. | **Construct Validity:** Independent-samples t-test; principal components analysis (PCA); and EFA. |
| 4 | Malone et al. (2012) | The General Belongingness Scale (GBS) | 12 | 7- point Likert Scale, rating choice format ranging from strongly disagree to strongly agree. | **Internal consistency reliability**: α = 0.95. | **Convergent Validity:** EFA. |
| 5 | Leary et al. (2013) | Need to Belong Scale (NTBS) | 10 | 5-point Likert Scale, ranging from strongly disagree (1) to strongly agree (5) | **Internal consistency reliability:** α = 0.78 to 0.87 (median α = 0.81). **Test-retest reliability:** α = 0.87. | **Construct Validity:** Item-total correlations, exploratory and CFA. |

*Note.* α = Cronbach's alpha

**Table 3**
*Continued*

| | | | | | | |
|---|---|---|---|---|---|---|
| 6 | Slaten et al. (2018) | The University Belonging Questionnaire (UBQ) | 24 | 4-point Likert Scale, ranging from strongly disagree (1) to strongly agree (4) | **Internal consistency reliability**: Study 1 α = .94; Study 2 α = 0.93. | **Construct Validity:** Study 1: EFA. Study 2: CFA. Bivariate correlations.<br><br>**Incremental Validity:** Hierarchical regression analysis |
| 7 | Williams et al. (2018) | The Higher Education Belonging Scale (HEBS) | 8 | Using Likert Scale but not explicitly explain the response options | **Internal consistency reliability:** Identity α = 0.66, Social α = 0.70, and Safety α = 0.77 | **Construct Validity:** EFA, CFA. |
| 8 | Freeman et al. (2007) | Adaptations of the PSSM | 25 | 5-point Likert Scale, ranging from completely to very true of me. | **Internal consistency reliability:** Class belonging α = 0.90, University belonging α = 0.79, Professors' pedagogical caring α = 0.75,Social acceptance α = 0.83. | **Construct Validity:** PCA. |
| 9 | Wilson and Gore (2013) | Adaptations of the SOBS and PSSM | SOBS: 26; PSSM: 18 | SOBS: 5-point Likert Scale, ranging from untrue (1) to true (5); PSSM: 5-point Likert Scale, ranging from not at all true (1) to completely true (5) | **Internal consistency reliability**: α = 0.82 to 0.90. School connectedness α = 0.77 to 0.88 | **Construct Validity:** CFA. |
| 10 | Lingat (2020) | Adaptations of the SSBS to create a Simple University Belonging Scale (SUBS) | 10 | 4-point Likert Scale (NO!, no, yes, YES!) | **Internal consistency reliability**: α = 0.91 | **Construct Validity:** Factor analysis. |

*Note.* α = Cronbach's alph

### *Scale Validation Analysis*

The research regarding SB in higher education is sporadic and inconsistent. The largest issue is the lack of a valid and reliable standardized scale to measure the SB construct. According to Tavakol and Dennick [23] reliability is related to the consistency of the measurement, and validity concerns the accuracy of the measurement. Reliability and validity are indicators of research quality, especially for measuring the complex construct of SB in higher education. In the existing literature, the reliability of the instruments for measuring SB in higher education can broadly be grouped into three types: (a) internal consistency reliability, (b) test-retest reliability, and (c) interrater reliability. Internal consistency reliability is the most wildly used type in the SB studies (# 3, 5, 6, 4). This type of reliability indicates the consistency of the measurement itself. For example, researchers can randomly split the SB survey or questionnaire results in half, compare the correlation between the halves, and see if they get the same results. Some researchers used test-retest reliability (# 2, 5, 1). This method measures the instrument consistency across time, whether the tests can get the same results if repeated in days, weeks, or months. A measure's interrater reliability is determined by comparing its performance across different raters or observers, whether the tests get the same results when different people conduct them.

A common method to measure reliability is Cronbach's alpha, with values of 0.7 or higher indicating acceptable internal consistency [23]. Using Cronbach's alpha, researchers proved good internal consistency in the following studies. Leary et al.'s [19] 10-item NTBS possessed acceptable internal reliability with Cronbach's alpha coefficients ranging from .78 to .87, with a median alpha of .81. Lee and Robbins [24] developed the Social Connectedness Scale and Social Assurance Scale. The values of internal reliability of these two scales with Cronbach's alpha are 0.91 and 0.82, respectively. However, for Williams et al.'s [25] HEBS, the internal consistency reliability is higher than 0.63, meaning one component of this instrument does not perform well, even though the researchers describe this component as having reasonable reliability.

Three types of validity of SB in higher education appear in the literature: (a) construct validity, (b) convergent validity, and (c) criteria-related validity. Construct validity indicates whether the test represents what it aims to measure. It is the most widely used validity in examining SB in higher education research (#2, 1, 6, 7). Methods for construct validity include EFA, CFA, PCA, contrasted groups, and comparison with other measures. For example, Lee and Robbins's Social Connectedness Scale and Social Assurance Scale achieved cross-validation with CFA (incremental fit index > 0.9). Hagerty and Patusky [18] tested the construct validity using factor analysis, contrasted groups, and comparison with other measures. Convergent validity refers to how closely a test relates to other tests that measure the same (or similar) constructs. For example, Malone et al. [22] used EFA to measure the convergent validity of their SB measuring instrument. An evaluation of criteria-related validity is conducted to determine if a test is capable of measuring the outcome for which it was designed. Akar-Vurral et al. [26] used this method in their research by calculating the correlation. Table 3 provides further details.

Based on the above summaries and comparisons, each SB instrument has its own strengths and weaknesses, and researchers can select different instruments based on their

research designs. However, multidimensional instruments are more appropriate for measuring SB in higher education due to the diversity and complexity of the construct. When assessing college students' SB experiences, researchers should take into account their social interactions, academic interactions, institutional belonging, and other relevant factors. Additionally, the survey or questionnaire instruments should be clear and concise, and researchers should avoid combining multiple SB instruments into one survey without modification. For instance, Wilson and Gore (2013) combined SOBS (26 items) and PSSM (18 items) to measure students' university connectedness, resulting in a lengthy instrument with 44 items. Furthermore, a good SB measuring instrument should possess high reliability and validity. Thus, it is crucial to consider reliability and validity during the instrument development process. Neglecting to test these properties may lead to research bias.

## Conclusion

Measuring SB has been challenging due to the complicated nature of belonging. For instance, SB has multiple definitions and components. Numerous theories across disciplines contribute to each of the components. Also, belonging research has occurred within multiple disciplines, including psychology [4], sociology [27], education [2], and so on. Moreover, SB research focuses on different layers of groups and exists in various settings. The theoretical and measurement issues must be understood and addressed to accurately portray the college students' experience and help researchers develop reliable and valid instruments. Building on the existing literature, this review summarizes the conceptual and operational definitions of SB in higher education, compares the existing SB measurement instruments, and outlines the psychometric properties (reliability and validity) in prior instrument development studies in higher education.

As has been shown above, each instrument has its own merits. Researchers can select different instruments based on their research designs. However, multidimensional instruments fit better in higher education because of their diversity and complexity. Among the 10 instruments I have analyzed so far, Slaten et al.'s [21] UBQ might be a suitable starting point or could serve as a default to determine if any other instrument works better for a study. Its conceptual framework includes four components: valued group involvement, intrapersonal factors, meaningful personal relationships, and environmental factors, which focus on academic and institutional belonging. However, combining general and social belonging would be better to emphasize individual needs and peer relationships. For example, we could add Leary et al.'s [19] NTBS, a unidimensional scale of belonging developed to assess individual differences in the desire for acceptance and belonging. The modified instrument will make the SB scale more comprehensive and accurate to measure college students' SB in higher education.

Despite the important contribution of the present work in comparing existing SB measurements, some limitations need to be addressed. The first limitation is the restricted databases used for searching articles. We only used the university EBSCO databases, and incorporating Google Scholar searches could help identify pertinent gray literature and additional literature, especially for citation screening. Furthermore, the articles are restricted to peer-reviewed journals, excluding peer-reviewed conference proceedings like those found in ASEE's PEER database. We should expand the search in future research.

In addition, each SB scale features different components, but it is necessary to state which components should be included in an effective instrument. Future research should modify existing instruments based on the research question and target group. For example, to measure engineering students' SB, we can combine current instruments related to higher education and select items relevant to the engineering field. Then, use cognitive interviews to refine these items and factor analysis to identify the final factors. Lastly, the reliability and validity of this instrument should be tested using EFA and CFA.

Moreover, researchers can now examine the impact of college majors on belonging and whether belonging is perceived similarly across types of colleges and majors, especially under varying campus racial climates. We should focus on developing and validating belonging questionnaires or surveys based on diverse groups in higher education, such as underrepresented minority students, female students in STEM fields, and so on. This would enable comparisons of the differences and similarities between these instruments. Finally, given the complex nature of the SB concept, further research is required to clarify the defining characteristics of belonging and address the conceptual overlap between related concepts.

Overall, in higher education, students' SB is essential for academic success and engagement. Therefore, it is important to incorporate students' SB into educational programs, practices, and research. A reliable SB measurement can not only help deepen the researchers' or practitioners' understanding of the existing SB instrument in higher education but also facilitate the future development of SB instruments in education. Simultaneously, it can help higher education institutions make informed policy decisions that impact college students' experiences.

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# Appendix A

**Table A1**

*Sense of Belonging Instrument Sample Summary Table*

| No | Source | Instrument (abbreviation) | Study Location | Sample Size | Sample age (mean) | Gender | Race | Institution (Major) | Grade Level |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Lee and Robbins (1995) | Measuring Belongingness | U.S. | Split-sample 1: N = 313 Split-sample 2: N = 313 Separate sample (for test-retest reliability): N=18 | Split-sample 1: 17-44 years (20.6) Split-sample 2: 17-48 years (20.7) Separate sample: 19-48 years (23.8) | Split-sample 1: 204 (65%) women, 107 (34%) men, two undisclosed participants Split-sample 2: 198 (63%) women, 112 (36%) men, and three undisclosed participants | N/A | A large urban southeastern University | Undergrad students |
| 2 | Hagerty et al. (1996) | Sense of Belonging Instrument (SOBI) | U.S. | N = 379 | 18 to 72 with a mean age of 26 years. | Females (59%) | 64% were Caucasian, 23% were African-American, 4% were Native American, 4% were Other, 3% were Asian, and 2% were Hispanic. | Community college | N/A |
| 3 | Hoffman et al. (2002) | the Sense of Belongingness Scale (SOBS) | U.S. | N = 205 | 18-20 years | 144 women and 61 men | 85% were Caucasian; 2% were African-American, 2% were Latino or Hispanic, 2% were Asian, and 9% identified themselves as “other.” | the University of Rhode Island | first-year college students |

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|---|---|---|---|---|---|---|---|---|---|
| 4 | Malone et al. (2012) | The General Belongingness Scale (GBS) | U.S. | Time 1: N = 81<br>Time 2: N = 875<br>Time 3: N = 213 | Time 1: 20.4 years<br>Time 2: 19.3<br>Time 3: 20.1 | Time 1: 49% females, 48% males, and 3% unreported<br>Time 2: 62% females and 38% male<br>Time 3: 58% females and 42% males | Time 1: 38% were Hispanic, 31% Caucasian, and 31% other<br>Time 2: 41% were Hispanic, 35% Caucasian, and 24% other<br>Time 3: 44% were Caucasian, 38% Hispanic, and 18% other. | Introductory Psychology students at a university in the Southwest USA | Undergrad students |
| 5 | Leary et al. (2013) | Need to Belong Scale (NTBS) | U.S. | Study 2 involved 815 college students;<br>Study 3 involved Participants were 92 college students; | N/A | N/A | N/A | N/A | N/A |
| 6 | Slaten (2018) | The University Belonging Questionnaire( UBQ) | U.S. | Study 1: N = 421<br>Study 2: N = 290 | Study 1: 18-25 years (20.04);<br>Study 2: 18-25 years (20.39) | Study 1: 54% female (n = 226) and 46% male (n = 195)<br>Study 2: 54% female (n=157) and 46% male (n=133) | Study 1: 80% White/European American, 11% Asian/Asian American, 3% biracial/multiracial, 3% Black/African American, 2% Latina/o, and 1% Native American<br>Study 2: 76% White/European American, 14% Asian/Asian American, 4% biracial/multiracial, 3% Black/African | Midwestern university | Undergrad students<br>Time1: 20% 1st year, 26% 2nd year, 20% 3rd year, 23% 4th year, and 11% above 4th year<br>Time 2: 13% 1st year students, 36% 2nd year, 26% 3rd year, 18% 4th year, and 8% above 4th year. |

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|---|---|---|---|---|---|---|---|---|---|
| 7 | Williams et al. (2018) | The Higher Education Belonging Scale (HEBS) | Australia | N = 632 | 17-60 years (23.38) | 354 females, 264 males, four non-binary students, and 10 students who did not indicate identification with a gender. | American, and 3% Latina/o Four hundred and thirty-eight (69.3%) of students reported being born in Australia. | A single Higher Education Institution | Undergraduate students |
| 8 | Freeman et al. (2007) | Adaptation of PSSM at university-level | U.S. | N = 238 | - | 60 men and 162 women, with 16 not reporting gender | 216 Caucasian students and 15 African American students, and 7 other minority ethnic groups. | Southeastern public university/ non major sections of biology, psychology, and English | First semester freshmen |
| 9 | Wilson and Gore (2013) | Adaptations of the SOBS and PSSM | U.S. | N = 529 | Between 19 and 23 years | Female 392 (74%); Male 137 (26%) | European American 409 (93%) | Eastern and southeastern regional comprehensive university | Undergraduate; Freshmen 259 (49%); Sophomores 146 (28%) |
| 10 | Lingat (2020) | Adaptations of the SSBS to create a Simple University Belonging Scale (SUBS) | U.S. | N = 4,851 | N/A | Male 3,158 (65.1%), Female 1,689 (34.8%) | Underrepresented Minority: Yes 738 (15.2%), No 110 (4.7%) | University of Kentucky | Undergraduate (53%) and graduate (47%) |