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MEASURING POSTSECONDARY STUDENTS' SENSE OF BELONGING: PSYCHOMETRIC INVESTIGATIONS INTO STUDENT DEMOGRAPHICS AND COURSE DELIVERY CONTEXTS

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DISSERTATION
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A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Education
at the University of Kentucky

By
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Lexington, Kentucky
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Lexington, Kentucky
2020

ABSTRACT OF DISSERTATION

MEASURING POSTSECONDARY STUDENTS' SENSE OF BELONGING:
PSYCHOMETRIC INVESTIGATIONS INTO STUDENT DEMOGRAPHICS AND
COURSE DELIVERY CONTEXTS

Research suggests sense of belonging in academic contexts influences student academic outcomes and well-being. Instruments (i.e., surveys, questionnaires) developed to measure sense of belonging mainly focus on the experience of students in middle grades. Few instruments measure sense of belonging experienced by postsecondary students, despite many colleges and universities seeking to improve retention, persistence, and graduation by addressing this complex construct. Furthermore, the rapid growth of online courses necessitates and presents an opportunity to employ psychometric investigations to explore the sense of belonging experienced by both face-to-face and online students. The first of the two studies conducted for this dissertation extends a brief instrument originally tested on an adolescent sample for use among postsecondary students, testing for differential item functioning based on various groupings, including but not limited to degree level, gender, and ethnicity. The second study investigates if it is possible to similarly measure students' sense of belonging to other students within the same course in face-to-face and online delivery methods using a common instrument. Employing modern measurement strategies, these studies demonstrate the value of rigorous analyses of internal structure to produce validity evidence for practical and reliable instruments—reflective of the diversity in student identities and learning contexts in higher education institutions—to measure postsecondary students' sense of belonging.

KEYWORDS: Postsecondary Students, Sense of Belonging, Measurement Invariance, Scale Development, Online Learning

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07/14/2020
Date

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PSYCHOMETRIC INVESTIGATIONS INTO STUDENT DEMOGRAPHICS AND
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07/14/2020
Date

DEDICATION

for my husband and family who tended to my mercurial nature
and the spaces in our togetherness

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Sir Isaac Newtown said "If I have seen further, it is by standing on the shoulders of giants" (Vernon, 2017). This dissertation, although my individual scholarship, could not have been possible without the steadfast mentorship and responsive instruction of my dissertation chair, Dr. Michael Toland, who is a giant of a mentor. My enthusiastic gratitude extends to my committee, and outside reader, respectively: Drs. Thomas Guskey, Shannon Sampson, Kenneth Tyler, and Jayson Richardson—all giants in their own right. Their thoughtful and thought-provoking guidance has made all the difference.

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Salamat Mahals: the other, better Mr. Novosel-Lingat, Mercados-Lingats, Novosels, Summer Girls, LuAnne, without my family and my Tribes, I would not have crossed the finish line and experienced true belonging: Sea Gals, C19 Users, Helms & Co., Pierce Mill, Cougar BN, BMPV jefas; and all the progenies—the joy, hope, future.

Last, this work was completed on occupied Shawnee and Eastern Band Cherokee land. Acknowledging the history of settler colonialism is only the beginning. *AMDG*

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CHAPTER 1. OVERVIEW

Students' sense of belonging has a long history of empirical research in educational and academic settings but has only recently gained momentum at the postsecondary level (Slaten et al., 2016). Higher education institutions have developed initiatives that deliberately address issues of belonging on university and college campuses. Despite these efforts to improve students' sense of belonging in postsecondary settings, there is a gap in the research literature. Moreover, the instruments developed to measure this construct are even more limited. Although several instruments exist and are intended for the empirical study of sense of belonging, only lengthy instruments are currently available as an option specifically developed for this academic level and has validity evidence (i.e., dimensionality, internal, correlational) for the score generation, use, and interpretation. These instruments are the Sense of Belonging Scale (26 items; Hoffman et al., 2002) and the University Belonging Questionnaire (24 items; Slaten et al., 2018). Another instrument by Yorke (2016) includes a six-item subscale intended to measure sense of belonging in higher education but has only been piloted in England, which is a postsecondary experience different from the context of the other instruments.

Additionally, rapidly increasing efforts to move higher education into the online learning arena further complicate how students experience a sense of belonging. Students who attend classes on campus might report their sense of belonging differently than students who take courses online (Decker & Beltran, 2016; Peacock & Cowan, 2018; Shea et al., 2015). Because of the emphasis on belonging at postsecondary institutions and shifting context of higher education into the online space, understanding the

experiences of undergraduate and graduate students' sense of belonging in both settings is important and timely.

My dissertation research focused on the construction and psychometric analyses of two distinct instruments intended to measure students' sense of belonging in postsecondary settings. The first study is an empirical extension of a brief instrument field tested on an adolescent sample but adapted for use with postsecondary students. For the second study, I investigated if it is possible to measure students' sense of belonging similarly in online and face-to-face learning contexts to other students within the same course using a single instrument. These two studies were guided by an integrated framework based on Tinto's (2017) model of student persistence and motivation and Bandura's (1986) Social Cognitive Theory. Employing modern psychometric strategies, I conducted a rigorous analysis of internal structure and provided validity evidence for practical and reliable sense of belonging instruments for use with postsecondary students, inclusive of the diversity in student identities and learning settings found in contemporary higher education institutions.

1.1   Research Objectives

For my dissertation, the first research objective was a measurement invariance study of an adapted instrument used in a postsecondary setting. Whiting et al. (2018) developed the Simple School Belonging Scale (SSBS) to address issues with the widely used Psychological Sense of School Membership (Goodenow, 1993b). I extended the SSBS by developing the Simple University Belonging Scale (SUBS) as a measure of postsecondary students' sense of belonging. This first objective included testing for differential item functioning across a variety of groupings (e.g., gender, ethnic group,

degree level) since previous literature has established differences in belonging needs of minoritized and marginalized students by (e.g., Hausmann et al. 2009; Hurtado & Carter, 1997; Hussein & Jones, 2019). Although campus wide efforts to increase sense of belonging may be geared towards the entire student population, these researchers have made the case that students from disadvantaged backgrounds require closer attention due to their susceptibility to drop out, fail, or not even begin college at all (e.g., Guiffrida, 2006; Museus et al., 2018; Strayhorn, 2012).

The second research objective was to utilize modern psychometric techniques to investigate the measurement of postsecondary students' sense of belonging to other students within the same course in online and face-to-face learning contexts. Online students were considered students who were enrolled in online courses and learning from a distance (i.e., students living off-campus and never stepping foot on campus to take any courses). Face-to-face students were considered students who attend classes on the physical campus of the university (e.g., students living in residence halls or off-campus but attending classes on-campus). This second research objective was met through a mixed method study, incorporating focus groups, expert review, cognitive interviews, and instrument development prior to quantitative analyses. Similar to the first objective, testing for differential item functioning was also conducted across student groups. Additionally, this new instrument was subjected to validity testing using related constructs.

The research objectives were developed with partners working with postsecondary students and the research was conducted on a sample of undergraduate and graduate students at a large southern university during spring 2020. Sample sizes were

determined based on recommendations by Scott et al. (2009) and participants were

randomly selected based on a selection criteria that reflected the university population.

CHAPTER 2. LITERATURE REVIEW

Belonging refers to the "strong desire to form and maintain enduring interpersonal attachments" (Baumeister & Leary, 1995, p. 522). Several theoretical frameworks have identified belonging as a basic psychological need associated with successful human functioning (e.g., Deci & Ryan, 1985; Maslow, 1943; Tinto, 2017). Psychological and physical outcomes—ranging from satisfaction and self-esteem to at-risk behaviors and mortality—have been associated with belonging (e.g., Cockshaw & Shochet, 2010; Walton & Cohen, 2011). As a phenomena studied vastly through different lenses, an abundance of instruments used to measure sense of belonging currently exists. Moreover, belonging has been interchangeably referred to and presumed to share conceptual similarities with other constructs (e.g., relatedness, social identity) in research. This leads to confusion and conflicting operationalizations of the construct. Despite the complexity associated with this line of inquiry, student perceptions of their belonging, commonly referred to as sense of belonging, is a leading construct of interest by researchers and practitioners alike.

2.1   Belonging as a Psychological Construct

From the scientific perspective of psychological research, belonging is earliest addressed within Maslow's (1943) hierarchy of needs, a seminal concept introduced as part of his theory of human motivation. Coupled with "love" in his proposed hierarchy, Maslow explained that belonging is attained after physiological and safety needs are met. Additionally, belonging influences the achievement of positive esteem of self and others and self-actualization, the final two basic needs identified in his hierarchy. Belonging as a basic human need is characterized by a "hunger for affectionate relations with people in

general, namely, for a place in his group, and he will strive with great intensity to achieve this goal…more than anything else in the world" (p. 381). Although Maslow acknowledged that this hierarchy is not fixed, he does identify maladjustment, aggression, and underdevelopment as possible consequences of thwarted belonging. Further conceptualization of belonging, like many other psychological theories and constructs, were based on Maslow's hierarchy of needs, considered to be a key contribution to human motivation theory (Hoffman, 1988).

As an isolated construct, the conceptualization of the specific need to belong was advanced by Baumeister and Leary (1995). Unique from established theories, including Maslow's, they believed that, "the field as a whole has neglected the broad applicability of this need to a wide range of behaviors" (pp. 497-498) when they developed their pivotal work. In particular, they proposed that those motives (e.g., power, achievement, intimacy) were not actually isolated psychological constructs, but rather constructs that are influenced by the need to belonging. The belongingness hypothesis, according to Baumeister and Leary, "is that human beings have a pervasive drive to form and maintain at least a minimum quantity of lasting, positive, and significant interpersonal relationships" (p. 496). Furthermore, they theorized that this hypothesis functions based on two features: maintained and frequent conflict-free interaction with others, as well as perceptions of bonds with others situated in committed, stable, genuine concern. That is, a person can satiate their need for belonging by participating in lasting interpersonal relationships based on shared regard and concern (p. 500). Based on this belongingness hypothesis, belonging needs may not be met by a sustained relationship or positive interactions alone, but by a combination of both.

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Related to the need for belonging, other researchers have investigated sense of belonging, particularly towards a group or social environment. Although the belongingness hypothesis (Baumeister & Leary, 1995) is considered the catalyst for this line of research, earlier work by Finn (1989) identified that an "internalized conception of belongingness…constitutes an important part" (p. 123) of education. Broadly, the perceptions that a person holds about their needs for belonging—not just the satisfaction of the need itself—influences behavioral outcomes. This was theorized by researchers (Goodenow & Grady, 1993; Newman et al., 2007) as a subjective interpretation which did not require reciprocation, but rather the perception of inclusion within the group or social context. The conceptualization of belonging was further explored by researchers investigating how an individual develops a sense of belonging. Walton and Brady (2017) synthesized social belonging research and defined sense of belonging as a "feeling of being accepted, included, respected in, and contributing to a setting" (p, 272). They continued to explain that a sense of belonging does not even have to fully be experienced, but rather the anticipation of that feeling can illicit the sensation. Furthermore, sense of belonging should not be restricted to active personal relationships, as proposed by the belongingness hypothesis. Instead, a person's sense of belonging might be simply dependent upon their perception of their social identity contextualized in a setting.

Belonging can be described through a long list of terms: affiliation, association, attachment, identification, membership, and so on. But in the research context, it is important to delineate what a need for belonging and what the sense of belonging refer to specifically. Whereas affiliation has been defined as the need to seek out social interactions (Hill, 1987; Leary et al., 2013), need for belonging can be considered the

innate desire for sustained, meaningful relationships that influences human motivation. Sense of belonging, on the other hand, is a perception. This perception is informed by personal assessment of personal identity, social environment, and the alignment of those two. For example, a person with a marginalized identity (e.g., women in STEM fields; Cheryan et al., 2009) would be assumed to report low sense of belonging in comparison with their peers who experience alignment with their identity and the social context, without having to experience a distant or negative personal relationship. This example emphasizes the extension of belonging, that "at stake is people's perception of fit between themselves and a setting…broadly, as either a specific school or work context or a broader civic or social community" (Walton & Brady, 2017, p. 273).

Although different terminology may exist in the literature to describe this phenomenon, the perceptions and behaviors that characterize belonging are straightforward. Baumeister and Leary (1995) described that behaviors associated with fulfilling belonging needs, such as social contact and forming bonds, should be expected in addition to cognitive activity and emotional reactions that demonstrate pursuit of those bonds (p. 500). Walton and Brady's (2017) chapter on belonging provides a comprehensive list of the questions to illicit responses that researchers can use to infer belonging. Rooted from the broad question at the heart of belonging, "Do I belong here?" (p. 272), the researchers presented several actions or responses that embody satisfaction of the need or the sensation of belonging. Walton and Brady included the following prompts to investigate belonging:

- Does anyone here even notice me?
- Are there people here whom I connect to?
- Do people here value (people like) me?
- Is this a setting in which I want to belong?

• Can I be more than a stereotype here?
• Are there people like me incompatible with this setting or behavior? (p. 276)

Based on their synthesis of social psychology intervention research (e.g. Murphy et al., 2007; Motto & Bostrom, 2001; Stephens et al., 2014), a number of maladaptive behaviors are observed from a lack of belonging. This included individuals displaying shyness, depression and disengagement, as well as feelings of invisibility and devaluation, corroborated by other research conducted in field settings, such as work and school environments (e.g., Cockshaw & Shochet, 2010; Goodenow & Grady, 1993). Lack of belonging has been associated with suicidal behaviors (Gunn et al., 2012) and physical pain (MacDonald & Leary, 2005). Additionally, Walton and Brady identified that certain responses to the social context provide further information about "who one can be in that setting" (p. 284). That is, if a person values the social context and finds reason to feel part of the ingroup (e.g., affirming experiences, positive representation in the context), responses, such as engagement, completion, and increased well-being indicate feelings of belonging and need satisfaction (Begen & Turner-Cobb, 2015; Chan, 2016; Steger & Kashdan, 2009).

2.2   Differences from Other Constructs

As a social construct, a person's perception of belonging shares, influences, and is related to other social psychological constructs, such as acceptance. Acceptance is described as an assessment of "standing, or reputation, within the peer group" by Wentzell and Caldwell (1997, p. 1198). From an organizational perspective, Ribera et al. (2017) described acceptance similarly as Wentzell and Caldwell, but instead of an evaluation of peer relationship, the assessment is of the person's relationship with the people and policies that are definitively part of the organization. Both at the peer and

institutional level, a person's sense of acceptance is an indicator of how valued and welcome they are with a group. Ribera et al. (2017) pointed out that, institutional acceptance is an experience "that may be surmised to relate to one's general sense of belonging at an institution and have often been studied in this fashion" (p. 547), it is distinctly different from belonging in that acceptance is determined by a power dynamic between the person and peers or members who are associated with the ingroup. In their study, peer belonging and institutional acceptance were not mutually exclusive—individual characteristics such as first-generation status and grades contributed to favorable feelings of one but not the other. Ribera and her team shared that in their study, "Disaggregating the complex concept of belonging into more than one measure illuminated the nuanced differences between building relationships with peers and feelings of acceptance by key institutional members such as faculty, advisors, administrative staff, and student affairs professionals" (p. 560). Belonging, instead, is built on stable relationships and positive affect, rather than perceptions of assessments by members already accepted. Wentzell and Caldwell (1997) described the existence of this power dynamic among peers as well, stating that acceptance by peers might "result in greater accessibility to resources that promote achievement, such as help with schoolwork and sharing of information" (p. 1206). Acceptance, unlike belonging, may disadvantage those in the outgroup—both at the individual and organizational level.

Being valued, and sense of validation, is another construct that is related to belonging yet maintains its own distinctness. Begeny and Huo (2018) defined being valued in as group as "looked up to or highly regarded" (p. 193). Like belonging, being valued is associated with not only mental health benefits, but also physical well-being.

Whereas acceptance was a feeling sourced from those held in regard, validation is sourced from those that are benefiting from a relationship with the person because of the contribution of that person. Although a person can be valued by someone in power, the criteria is no longer determined by the social context of the ingroup, but rather the personal strengths and influence of the individual seeking validation. As Begeny and Huo (2018), explained that "individuals with higher perceived status are seen as more prototypical—representing a stronger embodiment of the values and characteristics that help define the group as a whole…higher status individuals are more likely to see that group as defining or central to who they are (p. 196). Although sustained relationships and conflict-free interactions—components of the belonging hypothesis—would benefit from this type of regard, being valued has not been identified as a pre-requisite to belonging. As a closely related construct, and with the positive influence of being valued to health and well-being, ignoring the link between being of value and belonging would be an error.

2.3   Belonging and Individual Characteristics

Identity, both self and socially defined, is associated with belonging. Haslam et al. (2008) shared that "group memberships are not external to a person's sense of self; rather they are often internalised and incorporated into a person's global sense of self (i.e., who they are, what they stand for, and what they do)" based on social identity and self-categorisation theories (Tajfel & Turner; Turner, as cited in Haslam et al., 2008, p. 673). In turn, a person's sense of belonging is not simply experienced in the social context, but is influenced by intrapersonal characteristics and traits that the person holds. Social bonds, as a necessary component of belonging, is built on identification with others. As

Baumeister and Leary (1995) explained, "not only do relationships emerge quite naturally, but people invest a great deal of time and effort in fostering supportive relationships with others" (p. 502). But these relationships are not only built based on the personality or characteristics of an individual. To provide further nuance to their hypothesis about belonging, Baumeister and Leary explained that "belief systems lead to biased interpretation of social interactions, as well as to a biased interpretation of social interactions" (p. 510). Personal beliefs, such as political perspectives or attitudes towards social issues, informs the social bonds needed to develop belonging as much as a person's identity does. An intricate, interloped, and iterative relationship exists between belonging, identity, and beliefs.

Additionally, Baumeister and Leary explained that belonging has been linked to extroversion as a trait associated with building those necessary social bonds. Further, they cite a study by Hotard et al. (1989) that suggested satiated need for belonging is "sufficient to overcome the relative deficit in happiness that introverts suffer…introverts who have a good network of social relationships are just as happy as extroverts. Thus, introverts' deficit in happiness may be a result of their experiencing less belongingness" (p. 510). Related to happiness, belongingness can also develop confidence and sense of security. The regular, positive interactions and sustained relationship necessary to fulfill a need for belonging has been empirical found to develop confidence in people from marginalized groups, such as people with disabilities and women of color (Johnson, 2012; Mejias et al., 2014).

Experiences of belonging based on individual and group differences have been explored empirically. This is an indicator of the amount of effort and interest there is to

understand belonging from a variety of perspectives. For example, Goodenow and Grady (1993) conducted one of the first studies on belonging focused on adolescence, a particularly sensitive stage of developmental transition. This led the way to studies in the school and social settings, ranging from exploring the role of friendships to academic achievement to moral behavioral choices in relation to belonging (e.g., Anderman, 2003; Hamm & Faircloth, 2005; Schwartz et al., 2016). Another developmental stage of transition that has received attention is at the postsecondary level (e.g., Gray, 2017; Pittman & Richmond, 2008; Slaten, et al., 2016). Other researchers (e.g., Wastell & Degotardi, 2017) have begun to explore how belonging could be measured at earlier developmental stages with younger children, as well as belonging in workplace settings to capture a different stage of life (e.g., Chan; 2016; Cockshaw & Schochet, 2010). Beyond developmental stages and ages, belonging has also been studied based on individual differences, such as gender, race/ethnicity, and disability. For example, Newman et al. (2007) discussed the gender differences associated with internalization, disclosure, and peer nurturing—all important influences on social bonds and thus, belonging (p. 243). Although early work focused on a single individual difference and how it relates to belonging (Brutsaert & Van Houtte, 2002; Hurtado & Carter, 1997), current research regarding belonging addresses the intersectionality of identities, providing better insight on how belonging is experienced (e.g., Gummadam et al., 2016; Mejias et al., 2014; Rainey et al., 2018; Rosenthal et al., 2011). Belonging has even been studied in a variety of international settings including Mexico, Australia, and Turkey (e.g., Gonzales et al., 2008; Ho et al., 2017; Uslu & Gizir, 2016). Brown and Sacco (2017) conducted a study on physical appearances and found that people who report

higher belonging selected extraverted faces over introverted ones. For example, early research by Oyserman et al. (2006) described markers of belonging, which they describe as cultural or even physical attributes that are inclusion signals unique to specific groups (p. 854). This briefly captures the belonging research and interventions attempting inclusively capture all the ways the need is being satisfied and the sensation experienced by individuals from diverse contexts, backgrounds, and identities.

2.4   Group-Based Sense of Belonging

Newman et al. (2007) stated that "Humans beings are social animals; they mature over a long period in dyadic, small group, and other group contexts" (p. 241). Like the influence of individual characteristics on a person's sense of belonging, researchers have also investigated the characteristics of a group or organization as another potential influence on satisfaction of an individual's need to belong. Although groups exist in many social settings (i.e., schools, teams, workplaces), Kiesner et al. (2002) highlighted that "a group does not need to be real to have an effect on the individual…the individual believes to have a particular group and that the individual identifies with that group" (p. 206). Thus, the size of a group or organization may be limited to peers that share a friendship to full organizations with complex, social hierarchies. They further hypothesized that the influence a group may have on an individual does not have to be elicited or reciprocated, that individuals may experience the influence of the group and their characteristics. Newman and her colleagues (2007) pointed out that devalued groups (in their example, "brain" or "nerd" groups were explicitly mentioned) or groups that experience rejection from the social context increases the saliency of affiliation with that group and might result in a stronger sense of belonging. This shared experience, despite

being rooted in exclusion, results in close bonds as explained by the belongingness hypothesis. Further, this provides insight on the necessity of diversity within a group. That is, a group may or may not be diverse, but shared experiences that lead to commonality and close relations need to exist to develop a sense of belonging for someone. Baumeister and Leary (1995) explained how "social contact could overcome established intergroup prejudices and stereotypes" and that "external threat seems to increase the tendency to form strong bonds" (p. 502).

The inclusivity and culture of the group are also key characteristics that have an influence on developing an individual's sense of belonging. Walton and Brady (2017) outlined the context that promote belonging and identified that a more inclusive, supportive climate would promote an individual's sense of belonging. For example, by broadening representation and reducing group actions that seem a threat to a person's identity, groups can ensure that people feel valued. Additionally, groups that recognize and acknowledge individuals or facilitate commonality between group members can assuage belonging worries regarding visibility and intermember connection. Groups that discriminate, especially against minority and marginalized individuals, are particularly powerful at causing a reduced sense of belonging (e.g. Hurtado & Carter, 1997; Walton & Cohen, 2007). In their study of on campus discrimination and sense of belonging, Hussain and Jones (2019) concluded that "positive forms of social interactions with diverse others, including engaging in conversations outside the classroom…is protective against high levels of discrimination and bias on sense of belonging for all students of color" (p. 5). Though groups may be capable of lowering sense of belonging by enacting a discriminatory culture, groups are as equally capable of buffering biased interactions

and acting as a protective factor against discrimination. As Newman et al. (2007) said, "Relating to others in group situations and forming meaningful, enduring group connections are hard work" (p. 259).

Sense of belonging has become a popular topic of inquiry in educational research (Slaten et al., 2016). As a well-researched antecedent to student achievement and overall well-being, sense of belonging at school is the target of a number of programs and interventions (e.g., Pittman & Richmond, 2008; Walton & Cohen, 2011). But the same dilemma applies to the measurement of students' sense of belonging in academic settings: varying instruments with varying levels of quality to choose from and unclear conceptualization of the construct. In the school setting, Goodenow (1993a) described belonging as "being accepted, valued, included, and encouraged by others…feeling oneself to be an important part of the life and activity of the class" (p. 25). Like general belonging investigated outside the academic context, students' sense of belonging at school is defined or measured in the existing literature as school connectedness, school engagement, or sense of community (e.g., Beatty & Brew, 2005; Cunningham, 2007; Wang, Willett, & Eccles, 2011). Furthermore, students' sense of belonging research is beginning to appropriately extend beyond the P-12 school setting to postsecondary settings. Unfortunately, this line of inquiry is on track to experience the same measurement and conceptualization issues as elementary and secondary education (Slaten et al., 2016). This is a particular concern when bridging the research regarding belonging to the applied practice, with implications for both students and schools.

Like membership, there are several constructs that are closely related to, and sometimes used interchangeably with, belonging. Baumeister and Leary (1995)

delineated belonging as a different construct from attachment, specifically to particular

figures (i.e., mothers), but provide minimal guidance to other constructs related to human

motivation. Specifically in school belonging research, instruments designed to measure

connectedness (Lee & Robbins, 1995) and relatedness (e.g., Furrer & Skinner, 2003;

Guiffrida et al., 2008) were used in empirical research about student belonging. Even

attachment instruments have been used to measure school belonging (e.g., Gonzales et

al., 2008; Hernández et al., 2017), disregarding the delineation earlier posed.

2.5   Measurement of Belonging

Like most psychological constructs, belonging is commonly measured through

self-report surveys or questionnaires. Based on his work with Baumeister on the

belonging hypothesis, Leary and his colleagues developed the Need to Belong Scale

(Leary et al., 2013), which is one of the most widely used instruments. Other measures

have been developed to incorporate items that explore sense of belonging but as

component of a more general construct, rather than a unidimensional measure of the

construct itself (e.g., Bollen & Hoyle, 1990). Furthermore, psychometric issues were

identified on these existing instruments, including multidimensionality (e.g., social

connectedness and social assurance) and phrasing effects (e.g., unbalanced negative

phrasing). In response to instruments developed focusing on belonging needs met by

others and not an interpersonal sense of belonging (e.g., Hagerty & Patusky, 1995; Lee &

Robbins, 1995), Malone et al. (2012), developed the General Belongingness Scale (GBS)

to assess achieved or satisfied belonging balanced with lack of belonging.

Although there is broad acceptance of how to measure belonging based on the

conceptualization of the construct, there is not one instrument that has been accepted

fully. This is quite evident in the measurement of belonging in schools. The measurement of belonging has seen great development in the specific inquiry of how this construct is experienced and improved in schools, where a number of self-report surveys have been developed. Based on the belongingness hypothesis, the Psychological Sense of School Membership (PSSM) Scale developed by Goodenow (1993b) is one of the most frequently used instruments. Although other measures (e.g., Whiting et al., 2018) have emerged to address the issues identified with the PSSM (e.g., multidimensionality; You et al., 2011), it continues to be a well-used instrument (e.g., Booker, 2004; Nichols, 2008; Walker, 2012). Belonging research in the school has also led the way to other methods to the measurement of sense of belonging and the satisfaction of belonging needs. For example, Wastell and Degotardi (2017) used a qualitative approach that incorporated students' understanding and expression of belonging through storytelling and imaginative play in their learning environment. Other researchers (e.g., Slaten et al., 2014; Vaccaro & Newman, 2016) have conducted more formal qualitative research, interviewing then thematically analyzing experiences of students' belongingness.

Although these varying approaches to measurement might be seen as divergence and non-agreement within the field, it might also be considered an advantageous position for the study of this construct as researchers further seek a deep understanding, ever closer and more precise conceptualization, and importantly, measurement of belonging.

CHAPTER 3. THEORETICAL FRAMEWORK

Two theoretical perspectives are used to situate my dissertation. Bandura's (1986) Social Cognitive Theory and Tinto's (2017) updated model of student persistence and academic motivation (i.e., retention)—or, the sustained enrollment and integration of students at postsecondary institutions—are used concurrently to ground my investigation of personal and environmental factors in relation to behavioral outcomes. SCT proposes that three factors (i.e., personal, environmental, and behavioral) are bidirectional and best described through a reciprocal determinism model. Tinto specifically addresses the postsecondary experience in his model and states that retention is a function of a students' self-efficacy, sense of belonging, and perception of the curriculum.

3.1   Social Cognitive Theory

Social Cognitive Theory (SCT) addresses the relationships between thoughts, motivation, and performance. This theory, developed by Albert Bandura (1986), presents a model that accounts for the "mutual action between causal factors" (p. 24) in the relationships between personal, environmental, and behavioral factors. This theoretical framework attempts to explain the bidirectional relationships between the learning environment, student perceptions, and academic behaviors (i.e., achievement and retention; see Figure 3.1). For instance, the perceptions students might have about their sense of belonging at their university can influence how they participate within their university. Another consideration could be that students' beliefs about their classwork can influence their level of engagement and subsequent performance in the class. Through the SCT framework, each factor has an impact on the other two and changes in strength depend on the constraints of the situation (e.g., opportunities aligned to interests,

representation of similar people, curricular options). Bandura emphasized a person's

agentic role on these variables, stating that human behavior is more than just a series of

responses to internal drives or external reinforcers, but rather people have the capacity to

influence their own outcomes. In addition to agency, also referred to as independence or

autonomy, Bandura (1997) presented specific mechanisms of this complex cognitive

ability that attempt to explain learners' motivation and performance.

Figure 3.1

Bandura's (1986) Model of Triadic Reciprocal Determinism
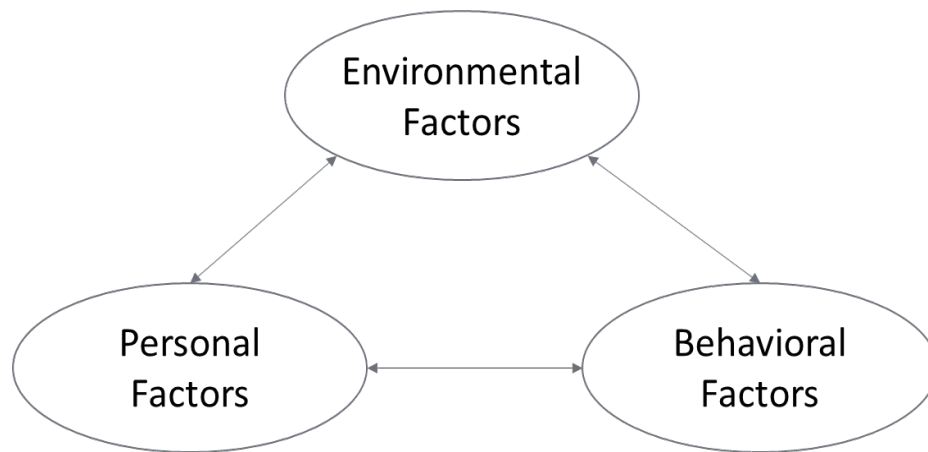
Agency, in contrast to unfiltered responses to internal drives or external

reinforcers, positions people as influencers of outcomes. But personal agency does not

exist in isolation. Rather, personal agency functions in relation to other factors. For

schools, this is an important theoretical principle that has implications for success or

failure. According to SCT, the social environment plays a particularly significant role.

Bandura (1986) states:

Social environments provide an especially wide latitude for creating conditions

that can have a reciprocal effect on one's own behavior…Because personal and

environmental influences function as interdependent determinants, rather than

autonomously, research aimed at estimating the relative percentage of behavioral

variation due to persons or to situations is ill suited for clarifying the transactional

nature of human functioning. (p. 29)

The SCT framework highlights agency while recognizing the relationship

between the environment and a person's beliefs and behaviors. As an integrated theory of

human motivation, it serves as an appropriate contextualization to investigate and

understand the experience of postsecondary students.

3.2   Tinto's Model of Retention

Recent empirical work has turned the attention on postsecondary student research

towards the influence of students' sense of belonging on retention, and ultimately

graduation (Han et al., 2017; York & Fernandez, 2018). The reasons why postsecondary

students enroll, persist, and graduate can be partially contributed to their sense of

belonging at their institution (Pittman & Richmond, 2008). For example, influences on

college success, such as peer and family networks, high school climate, and other factors

that contribute to a sense of belonging, have been linked to postsecondary retention, or

sustained enrollment. Additionally, Tinto (1987) states, regarding his popular theory of

student departure, that "individuals who perceive themselves as having established

competent membership, both socially and intellectually…are more likely to express a

strong commitment…to stay rather than leave" (p. 185). Furthermore, Bean and Eaton

(2000) connected Tinto's theory specifically to retention by identifying two key attitudes

important to retention. One encompasses attitudes about being a student, the other being

attitudes about institutional fit. Specifically, Tinto (1987) says that this "notion of 'fitting

in' with a group is not based on analytical jargon, but common sense notions of being similar to other members of a group and having a sense of belonging to that group" (p. 219). In 2017, Tinto issued an update on his perspective on retention and suggested a framework to view continued matriculation from the perspective of the student, rather than the institution (see Figure 2). This shift moves the discussion from the institutional actions to retain a student to the students' motivation towards higher education goals manifested as persistence. In this related, but distinctly different perspective, Tinto (2017) specifically identifies students' sense of belonging as a key variable.

Figure 3.2

Tinto's (2017) Model of Student Motivation and Persistence
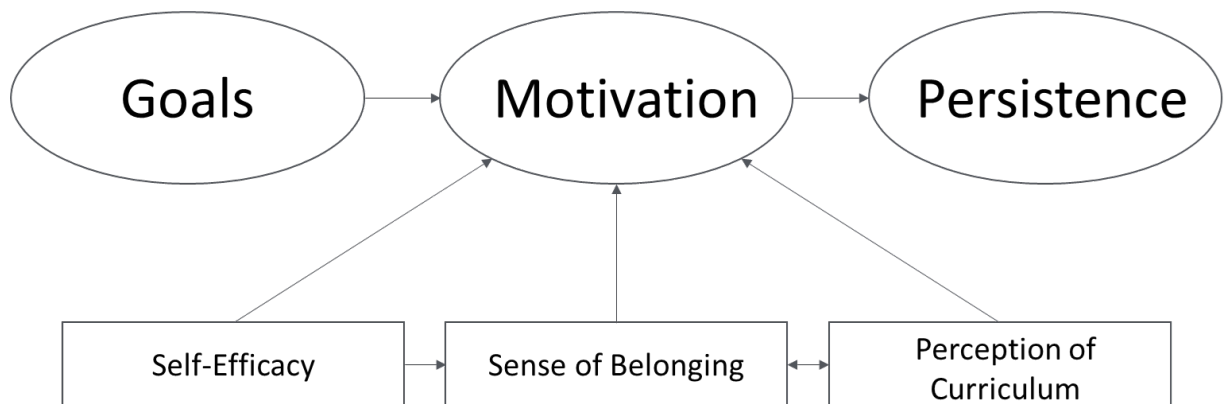
3.2.1   Sense of Belonging in Tinto's Updated Model

Tinto's original theory has been regarded by many scholars and practitioners as the catalyst to empirical research regarding student departure and institutional attempts at retention (Seidman, 2005). Though it has received well-argued criticisms, such as limited applicability to diverse student populations and institutional context (Tanaka, 2002;

Thomas, 2018)—as well as attempts at extensions—his theory of student departure has remained relatively unchanged (Braxton et al., 1997). Yet, with the advances in postsecondary education research beyond "common sense anecdotes" (Tinto, 1987, p. 214), Tinto incorporated sense of belonging as a key construct (along with self-efficacy and student perceptions of the curriculum) in his 2017 update. Tinto (2017) proposed a new model that highlights "several factors shaping student motivation that are within the capacity of institutions to influence" (p. 255). This model incorporates concepts from the student perspective from less popular, but parallel and competing student retention theories (e.g., Allen, 1999; Bean & Eaton, 2000) have been proposed.

According to Tinto (2017), students' motivation is a source of effort "enhanced or diminished by student experiences in college" (p. 255). Driven by goals—or the variety of reasons that lead students to college, such as degree completion, transferring to a different institution, or job qualification—motivation is malleable, according to Tinto. Further, he characterizes persistence as a manifestation of motivation and defined persistence as energy expended despite challenges encountered when trying to attain the goal. In this recently updated model, he proposes that students' sense of belonging, and its relationship with self-efficacy and perceptions of the curriculum, comprises a students' motivation. Sense of belonging, Tinto explains, in addition to students' self-efficacy and perception of the curriculum, maintains and enhances motivation, thus avoiding withdrawal and attrition from postsecondary education. He defines self-efficacy as a learned perception of ones' own ability to succeed in a situation or task. Sense of belonging, as explained by Tinto, is the perception that a student matters to a community (i.e., online or face-to-face classroom setting, department, college, or university) and that

students' participation is valued. Perceptions of the curriculum, based on Tinto's model, is students' judgement on the value and relevance of the instructional environment, informed by "faculty teaching methods, perceived institutional quality, and student learning style preferences and values" (p. 259). This model suggest that students must not only consider themselves as members of the community within an institution, but they must also have positive perceptions of meaningful engagement with others as part of their postsecondary experience.

Although this is a student-centered model, Tinto (2017) presented a list of research-based recommendations for institutions to promote students' sense of belonging, including a representative population and campus climate, where "no student should ever find him or herself out of place or unrepresented by the interests of others on campus" (p. 261). He also stresses the importance of positive engagement and warns against the lack of connection, for both the social and academic environment. By providing this conceptual model, which highlights motivational factors, especially sense of belonging, Tinto "provides a dynamic interface between the actions of the institution that seeks to retain students and… the likelihood of greater persistence while also addressing the continuing gap in college completion between students of different attributes and backgrounds" (p. 264). Although this necessary update provides new insights into Tinto's (1975) seminal work on retention, his conceptual model has only been cited 14 times according to a search of Tinto's (2017) article in Web of Science on September 2, 2019. This limited number of citations since the publication date suggests that this model has only been minimally extended to both practice and research on higher education institutions across the United States based on published work.

3.3   Integrated Frameworks

Together, these two theoretical frameworks (i.e., Bandura's model of triadic reciprocation and Tinto's model of student motivation and persistence) integrate the developmental motivation of individual learners with the unique context of learning at a postsecondary level. This dynamic integration of the two frameworks recognizes the complexity of a students' experience in higher education and emphasizes a particular stage in a person's development, as well as the specific environment of postsecondary education on campus. It is appropriate to consider the individual and institutional contexts to best understand how sense of belonging is conceptualized and the influence it may have on higher education achievement and retention.

CHAPTER 4. THE SIMPLE UNIVERSITY BELONGING SCALE: WORKING TOWARDS A MEASURE OF POSTSECONDARY STUDENTS' SENSE OF BELONGING (STUDY 1)

Sense of belonging plays an important role in postsecondary students' development and well-being. By adapting previous instruments typically used with middle school students, this study introduces a brief instrument, adapted and field-tested specifically for use with postsecondary students. Similar to the original instrument, the Simple University Belonging Scale (SUBS) is subject to unidimensionality testing as suggested by existing literature about this elusive construct. Additionally, the data will be tested for local item dependence, model-data fit, and measurement invariance through the Rasch framework. This series of analyses will be conducted to determine item-level psychometric properties when used with different postsecondary student groups common to higher education institutions (e.g., gender, ethnic group, degree level). Findings from this study are intended to provide support for both practitioners and researchers interested in practical and conceptual implications of postsecondary students' sense of belonging on academic achievement, retention, and overall well-being.

4.1   Introduction

Several studies have recognized the importance of measuring students' sense of belonging, particularly in the middle and high school settings (Goodenow & Grady, 1993; Wentzell & Caldwell, 1997). Goodenow (1993b) developed the Psychological Sense of School Membership (PSSM) scale and field tested the instrument specifically for use among fifth through eighth grade students. The PSSM has been administered to students outside of the adolescent age group, despite only being field tested with students from this particular academic stage. Although this instrument enjoys popularity beyond

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the original, intended context, it has faced criticism from methodologists. For example, You et al. (2011) suggested that the PSSM requires further psychometric investigation based on inconsistent and the multidimensional results. Finding the PSSM multidimensional is in direct conflict with the unidimensional nature of the construct suggested by foundational conceptualization of this complex construct (e.g., Baumeister & Leary, 1995. Goodenow & Grady, 1993).

As an alternative, Whiting et al. (2018) developed the 10-item Simple School Belonging Scale (SSBS) with the intention of creating an instrument that uses the PSSM as a source instrument, but extends the psychometric quality by reducing, revising and adding items to mitigate measurement issues associated with dimensionality and reliability, as well as scale development principles of practicality and parsimony. The SSBS is a unidimensional instrument that can be used to measure students' sense of belonging. However, like the PSSM, the SSBS remains limited to being field tested and intended to measure sense of belonging among adolescents in an academic context. A robust, unidimensional instrument is still needed to measure postsecondary students' sense of belonging at higher education institutions.

4.2   Literature Review

4.2.1   Measuring Sense of Belonging

Sense of belonging is a complex construct that has been well studied in the academic context, but remains conceptually elusive. Goodenow (1993a) describes belonging as "being accepted, valued, included, and encouraged by others…feeling oneself to be an important part of the life and activity of the class" (p. 25), as well as "the extent to which students feel personally accepted, respected, included, and supported by

others in the school social environment" (Goodenow, 1993b, p. 80). Baumeister and Leary (1995), presented a belongingness hypothesis that asserts "that human beings have a pervasive drive to form and maintain at least a minimum quantity of lasting, positive, and significant interpersonal relationships" (p. 496). Although these definitions similarly identify the relational nature of the construct as experienced by individuals, there remains scholarly conversations arguing the nature and uniform definition of students' sense of belonging. Based on an extensive review of existing literature, Walton and Brady (2017) presented a definition based on a synthesis of the existing social belonging research. They defined sense of belonging as a "feeling of being accepted, included, respected in, and contributing to a setting" (p, 272). Despite the rich, yet incomplete conceptualization of students' sense of belonging, this construct has been evidenced to influence student well-being and achievement. With growing interest in the measurement of students' sense of belonging and its' relationship with student success, instruments were quickly developed to conduct empirical research.

Goodenow (1993b) developed the popular PSSM scale which led to early empirical studies about students' sense of belonging. Over time, PSSM grew its broad prevalence in educational research and has even been used at the university level, despite concerns related to its psychometric quality. For example, Freeman et al. (2007), administered the PSSM in a cross-sectional study of first-year students at a higher education institution. The researchers found that sense of belonging at the course-level was associated with their beliefs about their instructors, encouragement to participate, and course organization; whereas their university-level sense of belonging was associated with students' sense of social acceptance. The authors expressed similar concerns as You

et al. (2011) regarding the consistency and dimensionality of the PSSM and recognized the limitations associated with response bias and class size.

The popularity of applied research on and empirical studies of students' sense of belonging has only grown since Goodenow's development of the PSSM (e.g., Hoffman et al., 2002; Newman et al., 2007), offering instruments that can be used as an alternative to the PSSM. Recently, Whiting et al. (2018) developed a short, unidimensional instrument as an alternative to existing instruments for use with adolescents. Whiting and her team shared measurement concerns about other instruments (i.e., PSSM), stating that there is "overwhelming evidence of the complexity surrounding measurement of school belonging that must be closely examined" (p. 176). In response, they developed a 10-item Simple School Belonging Scale (SBSS) that incorporated revised items from the PSSM, but also included additional original items authored by the research team through rigorous item development and validation process. This team utilized modern measurement techniques (i.e., factor analysis, item response theory) to address their shared concerns with other instruments expressed by researchers (You et al., 2011). Although they were intentional about their development process and utilized sophisticated procedures to contribute a more appropriate measure of students' sense of belonging, this instrument—despite strong psychometric qualities and improved construct validity—did not address the gap in instruments available for use with postsecondary students.

Slaten et al. (2018) recognized the lack of instruments specifically designed for use among postsecondary students, despite the expansion of interventions addressing students' sense of belonging as a response to the socio-temporal context of colleges and

universities "continually under pressure to increase retention numbers and funding for higher education" (p. 648). Aimed to address the lack of a qualitatively informed, a rigorously field tested instrument specifically designed for use at the postsecondary level, rather than adapted for the university context, the University Belonging Questionnaire (UBQ; 2018), was developed by Slaten and his team as an extension of their conceptual research on sense of belonging at the postsecondary level (Slaten et al., 2014; Slaten et al., 2016). However, the UBQ is a lengthy questionnaire. A brief instrument, similar to the SSBS (Whiting et al., 2018) does not exist for use with postsecondary students.

The present options for measuring students' sense of belonging in colleges and universities remain limited. The current instruments used in higher education are field tested for a different academic level, lengthy, or not designed using modern measurement techniques. Furthermore, these instruments have not been subject to robust psychometric analyses, which overlooks an opportunity to mitigate bias during data collection. These issues of fairness and validity limit the interpretations and subsequently lead to underinformed policy decisions at colleges and universities about groups of people, such as budget allocation, programming, and support services. Specifically, minoritized postsecondary students are susceptible to stigma-causing bias (Millsap, 2011), which is particularly concerning since higher education outcomes, such as retention and persistence, can be adversely affected by funding and policy decisions based on interpretations that are not valid due to imperfect measurement of constructs, such as sense of belonging (Museus et al., 2018; Vaccaro & Newman, 2015). The danger of this misunderstanding can unintentionally marginalize students based on inaccurate or inappropriate measurement. Tinto (2017), along with a number of other researchers, have

discussed the inequity experienced by minoritized and marginalized students at the postsecondary level (e.g. Baker & Robnett, 2012; Stebleton et al., 2014; Strayhorn et al., 2010; Vaccaro & Newman, 2017). This emphasizes the need for improved instruments, and as recommended by Whiting et al. (2018), and measurement invariance testing across diverse student groups. By engaging in measurement invariance testing as instruments are being developed, acknowledges, recognizes, and values the rapid increase in diversity in colleges and universities.

4.2.2 Measurement Invariance Testing

Ensuring that items on these instruments enjoy measurement invariance across different groups is an important issue of fairness and equity, especially in psychological and educational testing. Items used to measure constructs should be interpreted similarly by respondents, regardless of their group membership (e.g., gender, ethnicity). Measurement invariance between groups can be detected through specific techniques, such as differential item functioning (DIF). According to Walker (2011), biased cognitive testing that suggested disadvantages for some participants over others led to the development of DIF analyses as a measurement technique. This psychometric procedure was designed to detect "items in the test development process so that they can be edited or removed from the final version of a test" (p. 365). Walker (2011) further explains that "This verification represents an important aspect of the test validation process, in terms of defining the construct or constructs that are being assessed…as well as any additional constructs that may be measured by test items, is critical" (p. 366). Not only does this process alert the researchers that DIF exists within their research but provides the opportunity to explore the detected biases to further understand the layered complexity of

psychological constructs and educational phenomena. As Schmitt and Ali (2014) highlight, "differences (e.g., in culture, in language) in the populations being measured necessitate examining the degree to which the instrument measures the same construct across these groups" (p. 327).

The Joint Commission by AERA, APA, and NCME (2014) define DIF as "the circumstance in which two individuals of similar ability [levels of the construct] do not have the same probability of answering a question in a particular way" (p. 93). DIF testing is conducted to determine item-level variance, or differences in the item response data between individuals from different participant groups. Martinková et al. (2017) made the case that this is a practice that should occur during test development and not conducted as an obligatory step towards completion, reserved for the end of data collection. Martinková and her team further recommend that this procedure should not be utilized as a generic limitation at the end of a group comparison study. The researchers recommend that "DIF analysis should have a routine role in all our efforts to develop assessments that are more equitable measures of scientific knowledge" (p. 11).

The process of testing for and detecting DIF ensures respectful treatment of a human experience, a humble recognition that these constructs (e.g., sense of belonging, self-regulation, well-being) are complicated. DIF testing is an important procedure to ensure equity in educational and psychological measurement that ties into providing evidence for internal structure for an instrument as explained in the Standards (AERA, APA, & NCME, 2014). Multiple ways to test for measurement invariance are available (e.g. Ackerman, 1992; Millsap & Everson, 1993; Oshima et al., 2006) and present different benefits to the unique approaches.

4.2.3 Invariance Testing Using Rasch

One approach to test for measurement invariance is to fit the data to a model based on the Rasch model for measurement (Rasch, 1960). Initially developed for educational assessment, the Rasch model for measurement approach can also be used to estimate models for latent constructs, such as sense of belonging. The Rasch approach posits a straightforward principle that well-designed instruments reflect a probabilistic relationship between item difficulty and level of endorsement by person. Since the proposed instrument is an extension of an instrument with established factor analysis information, Rasch results can provide further sample-specific information, particularly item difficulty ranking and person ordering based on the data collected. By employing the Rasch approach, we can obtain person separation and item level fit, whereas a factor analytic approach would limit us to dimensionality and reliability results that have already been reported by Whiting et al. (2018) on the source instrument. Based on this relationship, the Rasch approach allows for comparisons of response patterns to an estimated model, identifying any deviations that "can be assessed…to reconsider item wording and score interpretations for these data" (Bond & Fox, 2007, p. 59). Similar to item level testing by Whiting et al. (2018), this approach allows researchers to investigate both the quality of the item and analyze responses based on the construct of interest. The Rasch approach is particularly appropriate for new instruments that will be administered to a sample with members from diverse groups since the "Rasch measurement model approach permits investigation of the biased items toward different subgroups and to inspect the construct irrelevant factors (i.e., gender, ethnicity, and academic background) via calculating Differential Item Functioning (DIF) measures" (Alavi & Bordbar, 2017, p.

12). As an approach that provides DIF information—similar to the procedure conducted by Slaten et al. (2018)—the Rasch approach is capable of invariance testing to address recommendations for fair and equitable measurement from AERA, APA, and NCME (2014). In addition to model-data fit and invariance testing, the Rasch approach also includes dimensionality testing at the appropriate level of analysis and provides important local item dependence and reliability information that are useful when assessing the psychometric health of an instrument. The suite of assessments possible through the Rasch measurement model approach (i.e., unidimensionality, local item dependence, model-data fit, and invariance assessment) sets itself apart as from other available techniques to utilize as the measurement of students' sense of belonging expands.

The measurement of students' sense of belonging has made great advancement, but the opportunity to provide a brief instrument to measure postsecondary students' perceptions of their relationships and interactions at colleges and universities remains available for researchers to address. Instruments designed to measure postsecondary students' sense of belonging are inadequate, particularly in the current context of an ever-evolving higher education landscape. Modern measurement practices have raised expectations for instrument development, as psychometric techniques have improved. Strategies, such as invariance testing during scale development, can help identify issues that may otherwise go undetected and possibly implicate interpretations. With issues of persistence, retention, and graduation associated with students' sense of belonging, appropriate instruments need to be developed that can meet the guidelines issued by AERA, APA, and NCME (2014). Addressing this opportunity with a brief instrument to measure postsecondary students' sense of belonging would allow researchers to test

models of student persistence and retentions and practitioners to make the best-informed decision to improve relationship and interactions at this academic level. A brief instrument is essential for responsive intervention and improvement of student retention, academic experience, and graduation.

4.3   Theoretical Frameworks

4.3.1   Model of Retention

Tinto's (1975) framework highlighted issues concerning retention, or the sustained enrollment and integration of students into postsecondary institutions. His framework is based on postsecondary students persisting through the difficulties of higher education. According to Tinto (2017), this is best achieved by ensuring fit between the individual and the institution. His theory emphasized the need in postsecondary learning environments to belong to a group and authentically connecting to a community in order to maintain matriculated until graduation. Although critiqued for its initial limitations to incorporate marginalized student experiences at higher education institutions, this model guided an extensive body of research (Seidman, 2005). Tinto updated his model in 2017, incorporating the perspective of the individual (i.e., postsecondary students) into the model. As more research on postsecondary students developed, his earlier theoretical stance to identify institutional interventions for student retention has progressed to a perspective that sets the centers the point of intervention on postsecondary students' perception of their experiences, including sense of belonging.

4.3.2   Social Cognitive Theory

Researchers have associated retention to constructs situated in related motivation theories, including Social Cognitive Theory (SCT; Bandura, 1986). Considering a

students' sense of belonging, their learning contexts, and the influence it may have on achievement and retention requires a theoretical framework that encompasses personal, environmental, and behavioral factors. SCT is based on a complimentary theoretical framework to Tinto's model that bridges the behavioral factors of student achievement (i.e., retention) and personal factors (i.e., sense of belonging) within the environmental context of a particular academic level: postsecondary, higher education. Studies in higher education, and the current study in particular, are appropriately situated in SCT since this framework accounts for not only the bidirectional relationship of behavioral and personal factors, but addresses the relationship of both with the unique environmental factors of colleges and universities. As an example, Han et al. (2015) conducted their study within the SCT framework. In their study with first-year undergraduates ($N = 1,400$), Han et al. found that student achievement and retention, as indicators of academic behaviors, were associated with student beliefs. These beliefs were manifested through four distinct student profiles (e.g., high across all academic mindsets, belonging-oriented, self-efficacy oriented, and low across all academic mindsets), informing researchers and practitioners of opportunities for intervention on student beliefs which influence their behaviors while at college.

4.3.3 Integrated Approach

These frameworks are individually tenable, but integrating these two frameworks present a compelling foundation for measuring students' sense of belonging. From the student perspective, according to SCT, personal factors—specifically sense of belonging, self-efficacy, and perceptions of curriculum—influence and are influenced by the learning environment (i.e., college and university settings) and achievement (i.e.,

retention, graduation). In Tinto's model, the influence of self-efficacy on sense of belonging and the bidirectional relationship of sense of belonging on perceptions of curriculum is identified. Tinto's updated model situates a postsecondary experience by associating those personal factors with a students' motivation which is influenced by their goals and influences their persistence (i.e., retention). The influence of environmental factors on postsecondary students' beliefs and behaviors are important factors, which has been evidenced by research specifically conducted on postsecondary students' sense of belonging by Slaten and his research teams (2014, 2018).

4.4   Purpose of Study

The purpose of this study was to extend the current work on students' sense of belonging by proposing a new instrument—the Simple University Belonging Scale (SUBS). This new instrument is brief, like the SSBS (Whiting et al., 2018), but adapted for use at a postsecondary, higher education institution. Furthermore, the new SUBS was subject to testing for measurement invariance across student groups that reflect the diverse student groups typically found in higher education. Other researchers have conducted invariance testing for differences between male and female responses (e.g., Slaten et al., 2018), but for this study, DIF tests were also conducted for underrepresented minority classification, degree level (undergraduate or graduate/professional classification), on-campus residency, and living-learning program (LLP) participation (only within the sample living on-campus or in the residence halls). Using the Rasch measurement model (1960) to assess for unidimensionality, local item dependence, model-data fit, and invariance, the current study answers the following research questions (RQs):

RQ1: Does the factor structure of the data support the interpretation of the SUBS as a unidimensional measure of postsecondary students' sense of belonging?

RQ2: Does the internal structure of the data provide evidence that items from the SUBS behave similarly across student demographic groups (i.e., gender, underrepresented minority classification, degree level [undergraduate or graduate/professional classification], on-campus residency, and living-learning program [LLP] participation)?

4.5   Method

4.5.1   Data Collection

I worked with the offices of Institutional Research (IR) and Student and Academic Life (SAL), which serves approximately 30,000 students, to collect data for this study conducted at the host university during Spring 2019. The sample ($N = 4,851$) from this predominantly White institution (PWI), reflected the demographic of the university population with majority undergraduate (53%) and female (65%), and only 15% identifying as part of an underrepresented minority group (i.e., American Indian/Alaskan Native, Black or African American, Hispanic or Latino, Native Hawaiian/Other Pacific Islander, Two or More Races). In this sample, 36% of the participants were on-campus residents and 24% were participants in LLPs. These demographics are summarized in Appendix Table A1.

Along with campus partners and research team members, I collaboratively collected data from undergraduate, graduate, and professional students separately during the Spring semester of 2019 (March to April) using an online survey platform. IR and SAL provided support to require students to use their individual university provided

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account prior to completing a university questionnaire in order for demographic information to be included in this study, as approved by the Institutional Review Board.

4.5.2   Measures

4.5.2.1   Simple University Belonging Scale

The research team and I developed the SUBS using items from the SBSS, adapting mentions of "school" with "university," "class," or the name of the university. Based on the 10 items proposed by Whiting and her team (2018), nine items were used for this context. Specifically, the item "People here notice when I am good at something" was not included in the SUBS based on feedback from university partners, who indicated that this item was not relevant to the student experience. The SUBS is rated on the same 4-point Likert-type response format (NO!, no, yes, YES!) as the SSBS. Items from the SUBS (Appendix Table A2) were presented randomly in the online survey to mitigate local item dependency.

4.5.3   Student Demographic Groupings

IR provided student demographic information to create groupings for the series of DIF analyses. This data were linked with student responses, rather than self-reported, to avoid confusion or conflicting information with institutional data.

4.5.3.1   Gender

Student gender identity was classified as either male or female. These binary options assumed cisgender participants and did not include options for transgender students.

4.5.3.2 Underrepresented Minority

Multiple categories for ethnic groups were available, but as a student group of interest, the university provided a binary classification for students who identified as Black/African American, Hispanic/Latinx, or Native American as an underrepresented minority. Identification with this group is associated with marginalization on campus.

4.5.3.3 Degree Level Type

Any students who were enrolled in a bachelor of arts or science program were considered "undergraduate" students. Any student enrolled in a masters, doctoral, or professional (e.g., JD, MD) program were classified as "graduate" students.

4.5.3.4 On-Campus Residency

Any student who lived in a university owned property was flagged by IR as an on-campus resident.

4.5.3.5 Living-Learning Program

Any students who were flagged as an on-campus resident was also flagged as a living-learning program (LLP) participant if they were accepted, invited, and enrolled to participate in a residential academic community. The partner university hosts 14 different LLPs, offering housing based on common academic interests (e.g., agriculture, STEM, etc.) and student identities (e.g., first generation, Honors College, international).

4.5.4 Data Analysis Using Rasch

Data analysis for unidimensionality, local item dependence, model-data fit, and invariance was conducted using the Rasch measurement model approach (1960). First, unidimensionality of the data was conducted to verify a similar factor structure to the

SSBS, which served as the source instrument. The proposed SUBS was expected to measure of one construct (i.e., postsecondary students' sense of belonging) and each item, which were adapted from the SSBS, are assumed to exhibit local independence between items (Whiting et al., 2018). Based on the theory and literature guiding the development of the SSBS and subsequent adaptation to the SUBS, the relationship between a postsecondary students' sense of belonging, and the probability that a respondent would endorse the SUBS item is positive and should be reflected in the model-data fit.

Then, a series of analyses to identify whether items on the SUBS exhibited measurement invariance across different postsecondary student groupings, specifically gender, underrepresented minority classification, degree level, on-campus residency, and LLP participation were conducted. Differences were expected in responses between groups as a result of group membership and not as an unintended measurement artifact. DIF analyses using the Rasch approach were only conducted if subgroup samples included at least 250 students (French & Maller, 2007).

Prior to conducting the data analysis, I evaluated the data following procedures outlined by Reise et al. (1993) and Toland (2014). During this inspection, it was determined that the data would provide better information if the response categories were collapsed from four response categories to two response categories (see Appendix Table A3). Collapsing the categories three options was considered, but pairing adjacent responses ensured appropriate interpretation of responses to the items (No!, no to No [0]; yes, YES! to Yes [1]). After employing this acceptable practice to truncate responses (p. 182, Chang & Englehard, 2016) on the data collected, I was able to move forward with

fitting a dichotomous Rasch model, specifically. In this model, the higher number (1) indicates greater sense of belonging and the log-odds form will be used to investigate the item and person location.

The following model for dichotomous data were used for the SUBS:

$$p\ (\ x_j = 1 \mid \theta, \delta_j) = \frac{e^{(\theta - \delta_j)}}{1 + e^{(\theta - \delta_j)}}$$

where,
$p\ (\ x_j = 1 \mid \theta, \delta_j) =$ probability of response $x_j = 1$;
$\theta =$ person location $(\infty; -\infty)$
$\delta_j =$ item j's location $(\infty; -\infty)$;

I used Winsteps Rasch measurement computer program (4.5.3, Linacre, 2020b) to fit the data to the Rasch measurement model using joint maximum likelihood estimation.

4.5.4.1 Unidimensionality Assessment

To answer the first research question, a principal component analysis of the residuals (PCAR) was used to evaluate the unidimensionality of the SUBS. Unidimensionality was assessed by inspecting the variance explained by the Rasch dimension, which is the primary dimension when the Rasch measurement model imposed on the sample data. This assessment included an examination of the variance in consideration of the assumption of fundamental unidimensionality, established by Linacre (1998; 2020a). According to Linacre, variance higher than 50% and standardized residuals of the eigenvalue of the first component less than 2.0 suggests that unidimensionality is tenable. In a Rasch analysis, unexplained variance by the subsequent dimensions that are less than 50% suggests that a second distinct trait, or multidimensionality, likely does not exist.

4.5.4.2 Local Item Dependence Assessment

Closely related to unidimensionality assessment, local item independence (or conditional independence) can provide assurance that unidimensionality and parameter estimation are not compromised. This is necessary in order to continue with Rasch analysis. Lord and Novick (1968) establish that items should only be correlated by the latent construct, such as sense of belonging, and no significant correlations should be shared between items after accounting for the latent variable.

Local item dependency (LID) was inspected by investigating the standardized residual correlations between a given item and other items on the instrument after accounting for the Rasch dimension using Yen's (1993) Q3 statistic. The cutoff value determined for LID was determined by calculating a critical value based on the Q3 matrix generated from standardized residual correlations. Researchers (Christensen et al., 2017; de Ayala, 2009) suggest that cutoff points are relative to the data, with critical values generally ranging from .1 to .7. Following procedures by Marais (2013) a critical value relative to the data, established as the Q3*, can be calculated as the comparison of the largest Q3 value with the average of all the residual correlations in the Q3 matrix and found to be stable around .20. For this instrument, Q3* was determined to be .15 as the critical value. This critical value was used for sensitivity testing on items suspected for LID.

4.5.4.3 Model-Data Fit Assessment

Evidence for the fit of the SUBS data to the model was determined using information weighted (infit) and unweighted (outfit) mean square values (MNSQ). Based on previous studies, I decided to use a range of .50 to 1.5 (Peabody et al., 2017). To

investigate the ordered structure of item difficulty locations and person endorsement levels, a Wright variable map was generated of the Rasch measurement model fit to the SUBS data. A Keyform was also produced for analysis in addition to the fit statistics and variable map to ensure proper order of response categories as part of model-data fit assessment.

4.5.4.4 Invariance Assessment

The second research question was answered by using the Mantel procedure (Holland & Thayer, 1988; Mantel, 1963) to investigate DIF across groups differences based on gender, underrepresented minority classification, degree level, on-campus residency, and LLP participation. The majority group was used as the reference group. Greater absolute values based on DIF contrasts, or the "size of the DIF across the two classifications…usually in logits" (Linacre, 2020a), suggests differences in difficulty between the two student groups. DIF contrast were noticeable at 0.5 logits. The Mantel procedure uses an odds ratio across the groups of interest to detect DIF by comparing how items perform by ability level between the two groups of comparison. To determine if group membership caused differences in how each item measured postsecondary students' sense of belonging, statistical significance was tested at the 5% significance level.

4.6 Results

4.6.1 Unidimensionality Assessment

To answer the first research question, the unidimensionality assessment of the internal structure of the SUBS was conducted on Winsteps (Linacre, 2020). First, the PCAR suggested a unidimensional solution represented the data. Specifically, a visual

inspection of the scree plot supported a unidimensional interpretation, with 64.7% of the variance (eigenvalue = 9.00) explained by the first Rasch dimension. The variance explained is greater than the 50% threshold suggested by Linacre (1998; 2020a). The following dimension explained only 10.1% (eigenvalue = 1.41) of the variance. These results suggest that a unidimensional interpretation of the data from the SUBS is tenable. However, this is only a partial answer to the first research question. The unidimensionality assessment satisfies the assumption of fundamental unidimensionality, allowing further investigation.

4.6.2 Local Item Dependence Assessment

Unidimensionality assessment was followed by local item dependency assessment. Results from this analysis showed that the standardized residual correlations ranged from absolute values of .10 (SUBS 2 with SUBS 3 and SUBS 7) to .23 (SUBS 6 with SUBS 9). Most correlations fell within the established Q3* (.15) and Q3 suggested by existing literature (.20; de Ayala, 2009, p. 134). SUBS6 ("Professors in my classes care if I am absent.") was found to have standardized residual correlations above .20, or over 5% of shared variability, with SUBS 3, SUBS 8, and SUBS 9. The residual correlations of SUBS 6 with SUBS 1, SUBS 4, and SUBS 5 were above .15, suggesting that SUBS 6 exhibited dependency issues with many of the items on the instrument. Following this inspection of the standardized residual correlations, a series of sensitivity analyses were conducted on the full SUBS with all the items and an adjusted SUBS without item 6 to compare the adjusted Q3 value to the critical value set at the local *Q3. It was determined that removing any of the items from the instrument at this stage of analysis based on LID would minimally improve item location and person endorsement

levels in the Rasch model. Since LID was considered negligible, all items were retained after item content review.

4.6.3   Model-Data Fit Assessment

Reliability assessment provided insight specifically on the degree of gradation on the SUVS to measure postsecondary students' sense of belonging. Person reliability, or the ability of the instrument to measure varying endorsement levels of sense of belonging, was found to be .16, below the preferred threshold of .80. Item reliability, or the extent SUBS items measured students' sense of belonging was 1.00, which implies that no errors were detected in this instrument to address the complexity of students' sense of belonging. According to Linacre (2020a), this reliability statistic is analogous to reliability in Classical Test Theory (i.e., Cronbach's alpha or specifically Kuder-Richardson's Formula 20 given that the items were treated as dichotomous herein). Perfect reliability, although desired, is rarely achievable, with the threshold for item reliability typically set at .90. These results for the full SUBS with all 9 items are summarized in Table 4.1.

Reliability assessment provided evidence that there is sufficient gradation within the proposed items to measure postsecondary students' sense of belonging. However, the reliability results of the person location estimates suggested that the SUBS exhibited limited ability to detect individuals that endorsed low versus high ratings of sense of belonging. Despite these imperfect separation statistic and reliability results, I continued to investigate the person location and item difficulty estimates.

Table 4.1

*Summary Statistics for 9-item Simple University Belonging Scale (*N = 4,851)

Measure	Students	Item
M	2.69	.00
SD	1.71	1.16
Separation statistic	.44	17.81
Reliability of separation	.16	1.00

Note. M = Mean or average measure. *SD* = Sample standard deviation.

The item locations for the SUBS and person location estimates are displayed on the Wright Variable Map in Figure 4.1. The distribution of the items on the right-half of the variable map (labeled by SUBS item number) does not align to the distribution of persons based on their level of sense of belonging (indicated by "#"). Winsteps visualized this misalignment by placing the means (i.e., "M" on Figure 4.1) for the item locations and person locations apart from each other on the variable map. The results displayed in Figure 4.1 show that SUBS 2 ("People at [University] are friendly to me.") was the easiest item to endorse and SUBS 3 ("I am included in lots of activities at [University].") was the most difficult item to endorse. In addition, the estimated locations of postsecondary students based on their level of sense of belonging were three standard deviations from the mean. This misalignment served as further evidence that the items on the SUBS were limited in capturing a nuanced levels of students' sense of belonging.

Figure 4.1

Wright Variable Map of all Simple University Belonging Scale Items

```
                      <more>|<rare>
       3 .###########  +
                       |
                       |
                     S |
             .###      |
                 .    |T
                 .    |
       2         .    +
                      |    SUBS3
                      |
                      |
               .#     |
                 .    |
                      |
                    M |S
                 .    |
       1              +
               .#     |
                 .    |    SUBS5               SUBS6
                      |
                 .    |
                      |
                 .    |    SUBS8               SUBS9
                 .    |
                      |    SUBS7
       0             +M
                 .    |
               . S    |
                 .    |
                 .    |
                 .    |    SUBS1
                 .    |
                 .    |
      -1              +
                      |
                      |S
                      |    SUBS4
                      |
                 .    |
               . T    |
                      |
                      |
      -2              +
                      |
                      |
                      |T SUBS2
                      |
                 .    |
                 .    |
                      |
                      |
      -3         .    +
                      <less>|<freq>
```
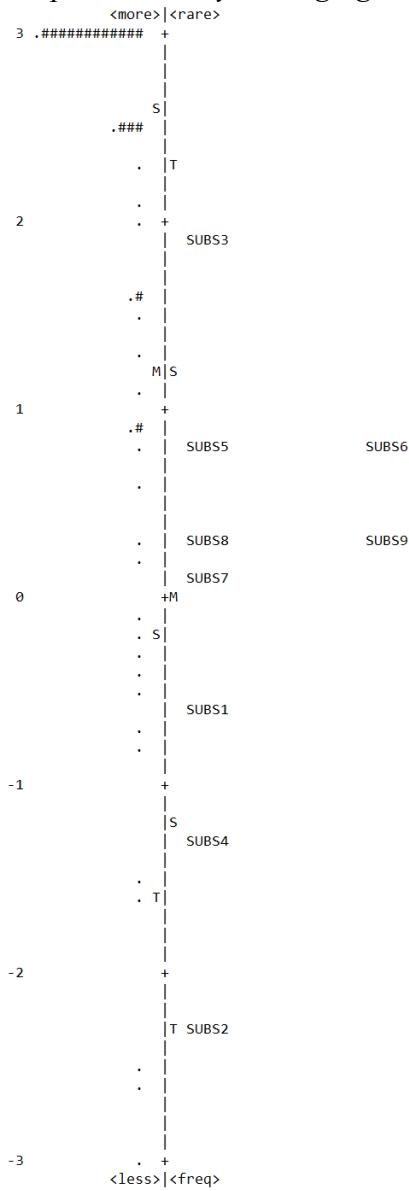
Note. This figure demonstrates the item location of the 9 items of the SUBS, and the person location for the residents who responded to the scale. Each "#" in the person column is 215 people; each "." is 1 to 214.

Further information about the SUBS items was ascertained through the keyform (Figure 4.2), which displays that the dichotomous ratings on SUBS items is appropriately distributed as item difficulty increases. Figure 4.2 visualizes the proportion of the

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dichotomized responses (0 = No, 1 = Yes) for endorsement. The keyform, like the

variable map, also provides information on the ordering of the item difficulty, reinforcing

that SUBS 3 was the most difficult and SUB S2 was the least difficult to endorse.

Considering the distribution with more students responding positively to the easiest item

(SUBS 2) and more students responding negatively to the most difficult item (SUBS 3),

the dichotomization of the response categories can be considered appropriate.

Additionally, Figure 4.2 demonstrates that the dichotomized response categories can

discriminate between the different level of endorsements, showing a distribution with two

steps and two levels. This further supports the use of two instead of four response

categories for the SUBS.

Figure 4.2

Keyform of the 9-item Simple University Belonging Scale

```
        -3         -2         -1          0          1          2          3
        |---------+---------+---------+---------+---------+---------|      ITEM
        0                                        0         :         1      SUBS3
        |                                                            |
        |                                                            |
        0                             0         :         1         1      SUBS6
        0                             0         :         1         1      SUBS5
        |                                                            |
        0                    0              :         1         1      SUBS8
        0                     0             :         1         1      SUBS9
        0                   0             :         1         1      SUBS7
        |                                                            |
        0              0          :          1              1      SUBS1
        |                                                            |
        0       0          :          1                    1      SUBS4
        |                                                            |
        |                                                            |
        0       :         1                                1      SUBS2
        |---------+---------+---------+---------+---------+---------|      ITEM
        -3         -2         -1          0          1          2          3
```
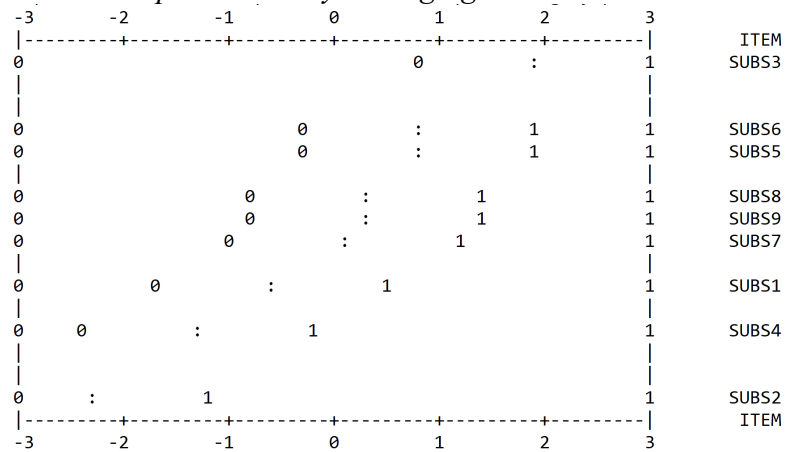
Note. Keyform illustrating relationship between expected response categories for each
item. Rasch-score-point threshold, ":" indicates Rasch half-point threshold or item
difficulty (location).

Figure 4.3 depicts an item (SUBS 8) that was found to have average endorsement difficulty to represent the model-data fit. There is a noticeable uniform discrepancy between the expected and empirical scores for students that report different levels of sense of belonging. The distribution of the empirical scores and their corresponding confidence intervals aligned with the expected item characteristic curve (i.e., item response function) expresses the monotonic relationship between the item difficulty and person location estimates.

Figure 4.3

Sample Item Character Curve (ICC) for Simple University Belonging Scale
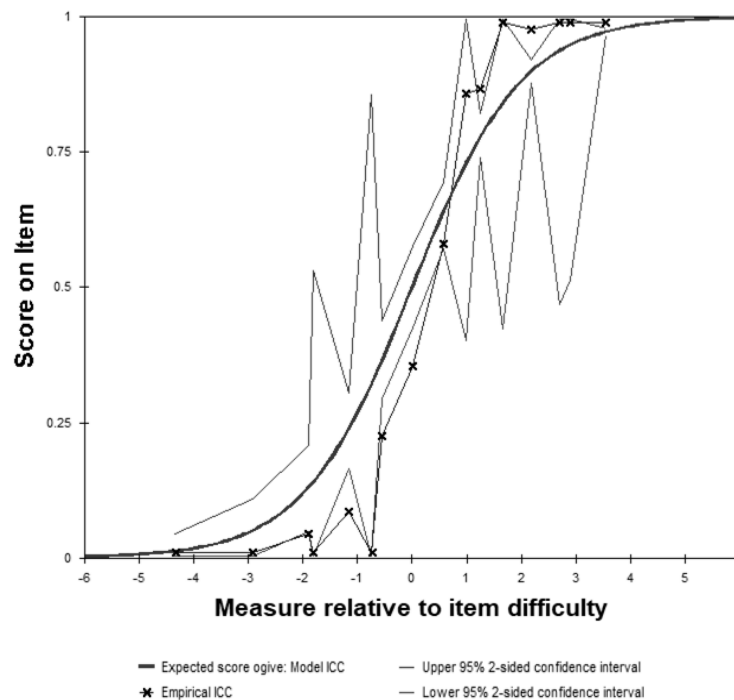
Note. Each "X" indicates a bin of individual scores to generate the expected and empirical ICCs.

The fit of the items on the SUBS to the Rasch model is summarized in Table 4.2. As determined through previous research, infit and outfit mean square (MNSQ) values considered acceptable for the SUBS were between .50 and 1.50 (Chang & Englehard,

2016) . The infit and outfit MNSQ statistic for all of the items range from .60 and 1.48., except for SUBS6, exhibiting misfit 1.60 for infit MNSQ and outfit MNSQ at 2.01. All items were maintained since these were all part of the source instrument (SSBS; Whiting et al., 2018), but SUBS6 has now been flagged twice; once during LID assessment and again during item fit assessment. Moving forward into DIF analysis, SUBS6 was closely monitored and considered for removal.

Table 4.2

Item Quality Index and Fit Statistics for Simple University Belonging Scale

No.	Item	Measure	SE	Infit	Outfit
6	Professors in my classes care if I am absent.	0.85	0.05	1.60	2.01
3	I am included in lots of activities at UK.	1.85	0.05	1.16	1.48
5	I like to think of myself as similar to others at UK.	0.80	0.05	1.08	1.05
7	I feel like I matter to people at UK.	0.08	0.06	0.91	0.81
2	People at UK are friendly to me.	-2.26	0.10	0.91	0.73
4	Other students at UK like me the way I am.	-1.29	0.08	0.90	0.70
1	Other students at UK take my opinions seriously.	-0.63	0.07	0.81	0.65
9	I feel like my ideas count in my classes.	0.28	0.06	0.73	0.64
8	People at UK really listen to me.	0.32	0.06	0.72	0.60

Note. SE = Standard Error. Infit and outfit based on mean square (MNSQ) fit index. Table sorted by Outfit.

4.6.4 Invariance Assessment

Similar to the first research question, the second research question also inquired about internal structure, which is another way to look at model-data fit, but involved item-level inspection for measurement invariance across student demographic groups. In the Rasch measurement model approach, DIF testing was conducted to determine measurement invariance between postsecondary students affiliated with groups based on gender, underrepresented minority classification, degree level, on-campus residency, and LLP participation (only within the sample living on-campus or in the residence halls). I

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conducted DIF analyses using the majority group as the reference group. Graphic

representation of the responses to the items were also visually inspected. For example,

Figure 4.4 (using data comparing on-campus residency) captures typical differences

between two student groups.

Figure 4.4

Differential Item Functioning Measure Based on On-Campus Residency
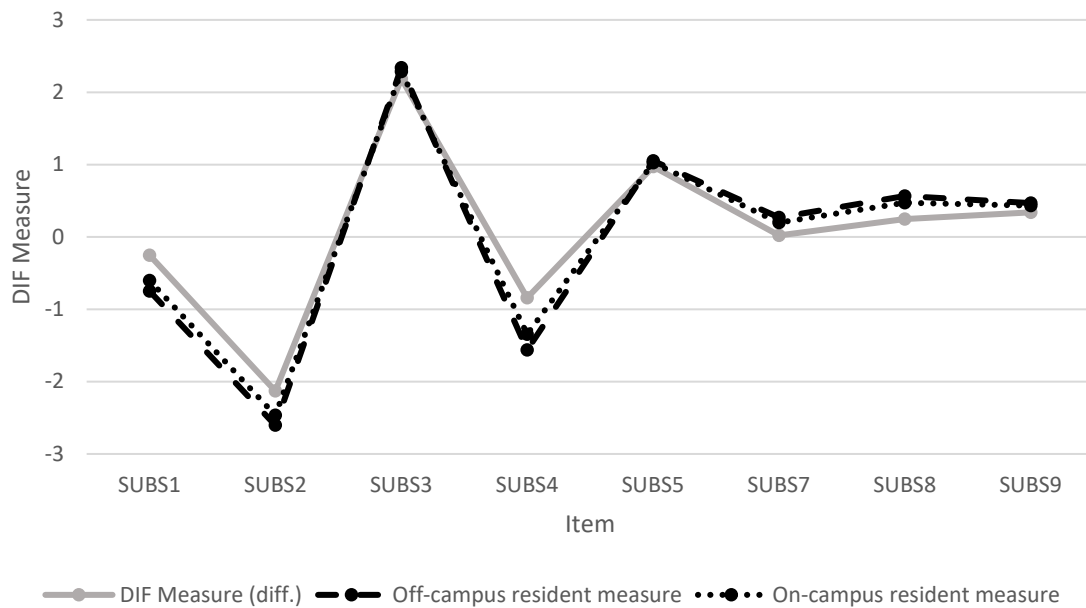
Note. Grey solid line = DIF Measure (diff.); Dashed line = Off-campus resident measure;
Dotted line = On-campus resident measure.

Further evidence to detect DIF was sourced from an item-level analysis, comparing the

responses of the majority of the specific student groupings. These DIF contrasts (i.e.,

logits based on DIF size; Linacre, 2020a) and Mantel procedure results are summarized

in Table 4.3.

Table 4.3

Summary of Differential Item Functioning Contrasts by Student Grouping Variable

	SUBS1	SUBS2	SUBS3	SUBS4	SUBS5	SUBS6	SUBS7	SUBS8	SUBS9
Gender	-0.29	-0.28	-0.03	0.19	0.48	0.00	0.03	0.07	-0.36
	(4.97)*	(2.34)	(0.16)	(1.18)	(16.27)*	(0.00)	(0.10)	(0.39)	(12.92)*
URM	-0.16	0.17	0.35	0.04	-0.63	0.23	0.22	-0.06	0.08
	(0.34)	(0.09)	(3.95)*	(0.12)*	(17.29)*	(0.24)	(1.99)	(0.00)	(1.13)
Degree	-0.03	0.29	-0.27	0.18	0.19	1.18	-1.26	0.36	-0.23
	(0.00)	(0.75)	(2.60)	(0.81)	(1.02)	(45.04)*	(82.99)*	(7.69)*	(4.49)*
On-campus	-0.22	-0.27	0.60	-0.46	0.40	-1.70	0.47	0.56	0.39
	(9.26)*	(1.27)*	(44.27)*	(13.36)*	(14.79)*	(98.96)*	(6.87)*	(6.83)*	(2.15)
LLP	0.14	-0.11	0.84	-0.68	0.32	-1.70	0.27	0.50	0.43
	(0.00)	(0.16)	(38.51)*	(14.32)*	(4.38)*	(58.10)*	(0.31)	(1.45)	(0.99)

Note. SUBS = Simple University Belonging Scale. Mantel χ^2 included in parentheses. Reference group for Gender = male; URM = is not URM; Degree = undergraduate; On-campus = lives off-campus; LLP = does not participate in LLP.
* $p < .05$.

The absolute value of the DIF contrast fell within 0 and 1.70 logits. Large DIF contrast, or values greater than the threshold of .50 logits, were found for SUBS 6 between undergraduate and graduate students (1.18), on-campus and off-campus residents (-1.70), and LLP residents and non-LLP residents (-1.70). Additionally, responses from undergraduates and graduates suggested large DIF contrasts for SUBS 7 (-1.26). Further, items identified for DIF at a statistically significant level ($p < .05$) by the Mantel procedure were present for student groupings by gender (SUBS 1, 5, and 9), underrepresented minority status (SUBS 3, 4, and 5), degree level type (SUBS 6, 7, 8, and 9) and LLP participation (SUBS 3, 4, 5, 6, and 7). DIF testing based on student groupings by on-campus residency suggested the presence of DIF on all the SUBS items except SUBS9. Furthermore, eight items (out of the 9-item instrument) demonstrated

significant Mantel tests results when comparing responses from postsecondary students residing on-campus to their counterpart peers living off-campus.

The fit statistics, evidenced by the MNSQ (infit = 1.60; outfit = 2.01), on the item SUBS 6 ("Professors in my classes care if I am absent") is a specific instance that justified the removal of this offending item from the SUBS. After removing SUBS 6, the same model-data fit and invariance assessments were conducted on the adjusted instrument (all items, except SUBS 6). Estimates for the reduced instrument (Table 4.4) demonstrated that SUBS 7 did present a large DIF contrast between undergraduate and graduate/professional students (1.21), as well as SUBS 4 when DIF testing between LLP and non-LLP students (1.07), but neither was as extreme as the difference in difficulty across groups observed in SUBS 6. This analysis was repeated after removing additional items SUBS 4 and SUBS 7 (Table 4.5) to further purify the scale. The removal of these specific additional items (i.e., SUBS 4, SUBS 7) produced DIF contrast below or slightly above the threshold. SUBS 1, 2, and 5, had DIF contrast between 0.50 to 0.60. This assessment of the DIF contrast were followed by considerations of the Mantel χ^2 results.

Table 4.4

Summary of Differential Item Functioning Contrast Values by Student Groupings Without SUBS 6

	SUBS1	SUBS2	SUBS3	SUBS4	SUBS5	SUBS7	SUBS8	SUBS9
Gender	-0.31	-0.26	-0.12	0.25	0.53	0.03	0.07	-0.42
	(4.99)*	(0.98)	(0.68)	(2.28)	(17.05)*	(0.08)	(0.21)	(12.74)*
URM	-0.13	-0.25	0.50	0.07	-0.69	0.28	-0.03	0.14
	(0.26)	(0.66)	(6.85)*	(0.12)	(19.16)*	(2.39)	(0.00)	(1.33)
Degree	0.14	0.41	-0.11	0.38	0.37	-1.21	0.55	-0.13
	(1.28)	(1.86)	(0.34)	(2.69)	(4.44)*	(63.98)*	(16.97)*	(0.57)*
On-campus	0.49	0.47	-0.15	0.72	-0.08	-0.24	-0.32	-0.13
	(16.17)*	(3.39)	(9.04)*	(18.92)*	(0.93)	(3.62)*	(0.81)	(0.00)
LLP	-0.11	-0.49	0.47	-1.07	-0.05	-0.03	0.20	0.12
	(0.57)	(1.44)	(12.95)*	(22.21)*	(0.00)	(0.00)	(0.02)	(0.01)

Note. SUBS = Simple University Belonging Scale. Mantel χ^2 included in parentheses. Reference group for Gender = male; URM = is not URM; Degree = undergraduate; On-campus = lives off-campus; LLP = does not participate in LLP.
* $p < .05$.

Following the inspection of the DIF contrast by student demographic group, the Mantel χ^2 statistic was inspected. A number of items were flagged for DIF based on a significant p value, but the only item with extreme DIF contrast statistic as well as significant Mantel χ^2 statistic was SUBS6 when comparing response between undergraduate and graduate students ($\chi^2 = 45.04$, $p < .001$), on-campus and off-campus students ($\chi^2 = 98.96$, $p < .001$), and LLP and non-LLP students ($\chi^2 = 58.10$, $p < .001$). These results are summarized for the full SUBS, adjusted SUBS without SUBS6, and adjusted SUBS without SUBS 4 and 7 on Tables 4.3 to 4.5.

Table 4.5

Summary of Differential Item Functioning Contrast Values by Student Groupings Without SUBS 4, 6, 7

	SUBS1	SUBS2	SUBS3	SUBS5	SUBS8	SUBS9
Gender	-0.30	-0.15	0.13	0.59	0.10	-0.41
	(4.08)*	(0.22)	(0.20)	(19.68)*	(0.49)	(11.25)*
URM	-0.07	0.10	-0.28	0.22	0.00	0.20
	(0.06)	(0.01)	(2.07)	(1.77)	(0.01)	(2.44)
Degree	-0.08	0.41	-0.11	0.37	0.39	0.32
	(0.08)	(1.86)	(0.34)	(4.44)*	(6.58)*	(4.73)*
On-campus	-0.53	-0.50	0.04	0.03	0.31	0.11
	(14.09)*	(3.10)	(3.46)	(0.26)	(1.32)	(0.05)
LLP	-0.20	-0.60	0.31	-0.19	0.11	0.02
	(1.03)	(1.29)	(5.62)*	(0.44)	(0.01)	(0.04)

Note. SUBS = Simple University Belonging Scale. Mantel χ^2 included in parentheses. Reference group for Gender = male; URM = is not URM; Degree = undergraduate; On-campus = lives off-campus; LLP = does not participate in LLP.
* $p < .05$.

Assessing the full model and two adjusted models using the DIF contrasts and Mantel χ^2 statistics demonstrated that the change was negligible after SUBS 6 was removed, with the exception of DIF being alleviated from SUBS 3 and 5 for the URM comparison after SUBS 4 and 7 were removed. As seen on Table 4.6, there was a decrease in the estimates for the separation statistic and reliability of separation, as well as infit and outfit statistic based on the mean square, for person location as items were removed from the SUBS. It was decided that the final reduced instrument omit the original SUBS 6 ("Professors in my classes care if I am absent."). SUBS 4 ("Other students at UK like me the way I am.") and 7 ("I feel like I matter to people at UK.") were maintained due to the content of the items and less convincing evidence that

removal would lead to more improved instrument quality. The SUBS was finalized, without SUBS 6.

Table 4.6

Summary Statistics for Adjusted Versions of Simple University Belonging Scale (N = 4,851)

Measure	SUBS without item 6		SUBS without items 4, 6, 7	
	Students	(8) Item	Students	(6) Item
M	2.85	.00	2.65	.00
SD	1.82	1.37	1.84	1.57
Separation statistic	.42	18.73	.33	20.29
Reliability of separation	.15	1.00	.10	1.00

Note. M = Mean or average measure. *SD* = Standard deviation. Separation statistic is the sensitivity of person and item location estimates. Reliability of separation is an index of reproducibility of person and item location estimates.

4.7 Discussion

This study presents the SUBS, a new instrument to measure students' sense of belonging, specifically adapted and field tested for use among postsecondary students, extending existing measurement work by previous belonging researchers, notably Goodenow (1993b), Slaten et al. (2018), and Whiting et al. (2018). Recognizing the diverse group membership represented at colleges and universities, this instrument was subjected to measurement invariance testing through the Rasch measurement model approach (1960) to ensure the development of a fair and equitable instrument, in accordance with the guidelines presented by AERA, APA, and NCME (2014).

4.7.1 Internal Structure

Both conceptual work (e.g., Baumeister & Leary, 1995; Goodenow & Grady, 1993; Maslow, 1943; Tinto, 2017) and empirical studies (e.g., Slaten et al., 2018; Whiting et al., 2018) establish students' sense of belonging as a unidimensional construct. Findings from dimensionality assessment allowed for not only unidimensional

treatment of the data, but it also ensured that existing literature that characterizes sense of belonging as a single latent psychological construct is reflected in the items individually and instrument as a whole. As an affirmative response to the first research question, these findings confirmed the SUBS instrument to be reflective of the theoretical underpinnings that guide the measurement of this construct. This also established that the new instrument was an appropriate extension of currently existing work, particularly the SSBS developed by Whiting et al. (2018), which was also evidenced as a unidimensional instrument. The findings on the SUBS demonstrate that any theoretical or measurement concerns with existing instruments by researchers (e.g., You et al., 2011) were mitigated during this scale development process.

Furthermore, results provided reliability evidence for sufficient item difficulty gradation but reduced ability to detect individuals that endorsed low versus high ratings of sense of belonging. In the context of Rasch analysis, reliability alludes to the reproducibility of the data, not necessarily an indicator of the instrument's ability to measure the construct (Linacre, 2020a). Although the low reliability found for the estimation of person separation statistic (.10 to .16) can be considered analogous to classical test theory reliability (i.e., Kuder-Richardson Formula 20), this Rasch measurement model approach to reliability should not be interpreted with the same accord. The reliability results of both the estimated item difficulty and the person location does provide useful insight on the SUBS. Based on the reliability of the item and person separation indices, the dichotomous Rasch model for this data is less than ideal. First, the reliability exhibited by the items—despite being "perfect"—actually elicited suspicion, rather than confidence. Linacre (2020a) recommends item difficulty reliability around

.90, allowing for some error in instruments that measures a latent construct. Other

students' sense of belonging instruments, for example, Whiting et al. (2018) and Slaten et

al. (2018) both report reliabilities (albeit, using Chronbach's alpha) under 1.00 on the

SSBS (α = .96) and UBQ (α = .93), respectively. Second, the estimated person location

separation index (.10 to .16) as a measure of sensitivity is well below the threshold of .90,

as established by Linacre (2020a). This is a concerning result since this essentially

questions the ability of the instrument to distinguish a postsecondary student who can

easily endorse the items on the SUBS and a postsecondary student who has difficulty

endorsing the same items. Post hoc analyses were conducted on an adjusted data set,

removing extreme cases from the sample that contributed to the observed negative skew.

The person separation statistic for this adjusted sample (n = 2,074) was improved to .56

based on data from the full set of SUBS items, indicating an issue with the original

sample, rather than the item itself. In other words, based on the skewed sample used for

this study, the SUBS may not be an instrument that can discriminate whether students

experience an abundance or an absence of sense of belonging. But adjustments to

mitigate the skew of the data suggests that sample size and composition are contributing

to the issues identified during the internal structure analyses. Overall, these reliability

results, paired with potential LD concerns caused by SUBS 6, furthered skepticism about

the psychometric qualities of the SUBS.

4.7.2 Model-Data Fit

The assessments conducted in the Rasch measurement model approach provided

key information towards understanding the construct and measurement of sense of

belonging among postsecondary students. As an adapted instrument, we were pleased to

find that the data collected on the SUBS support unidimensionality, but were concerned about local item dependence, and moreover, measurement invariance exhibited by groupings associated with on-campus housing and LLP participation, as well as degree level types. Despite these concerns, only one item was removed due to convincing evidence based on local item dependence and DIF results, producing a final version of the SUBS comprised of 8 items.

A few trends can be ascertained from the fit assessment. Specifically, the clustering of the SUBS items and positive skew of the person location estimates required critical discussion.

First, the SUBS items adapted from Whiting et al.'s (2018) SSBS seem to be along a continuum of difficulty with majority of the items clustered around the middle to hard range, which could be seen on the variable map (Figure 4.1) within one standard deviation of the mean towards more difficulty. Items such as SUBS 7 ("I feel like I matter to people at [University]"), SUBS 8 ("People at [University] really listen to me"), and SUBS 9 ("I feel like my ideas count in my classes") are appropriate indicators of postsecondary students' sense of belonging, reflecting conceptual ideas of positive interactions by Baumeister and Leary's (1995) belonging hypothesis and Goodenow and Grady's (1993) investigation of this construct in an academic setting. Other items, such as SUBS2, which was the easiest item to endorse, and SUBS 3, which was the most difficult item to endorse, reflected sense of belonging from external sources (i.e., others at the university, including students, professors), which does not align to key theoretical underpinnings of the perception a student has about their interactions and relationships. These items may be at the extreme opposites of endorsement distribution because they do

not apply in the context of higher education, whereas they may be more appropriate for the adolescent audience the Whiting et al.'s (2018) SSBS was originally intended for.

Second, the distribution of estimated person location seemed to be skewed towards the positive extreme of the variable map. This is most likely due to items being easy to endorse and may not have the ability to discriminate between postsecondary students who have more nuanced gradations of sense of belonging during their college or university experience. We followed Chang and Englehard (2016) guidelines to collapse response options and again heed their recommendation to incorporate an increase in the "level of challenge in the item" (p. 186). Although this is more applicable for an instrument intended to measure perceptions about ability, this same advice applied to latent construct measurement has merit. Additionally, the original belonging items were intentionally designed for use with adolescents by Whiting and her team (2018), which inherently may be a less demanding cognitive level for the young adults who responded to the adapted version of the items on the SUBS. Based on this insight from these researchers, perhaps items that are phrased to require deeper reflection about sense of belonging may be appropriate for postsecondary students, leading to improved gradation of estimated person location.

4.7.3   Measurement Invariance

After investigating and adjusting for offending items (SUBS 6), results provide evidence that, in general, items on the SUBS behave similarly across these student demographic groupings. Differences in students' interpretation of items designed to measure sense of belonging seem to occur with students who either live off-campus, do not participate in an LLP, are graduate/professional students. However, upon further

examination of each item with the consideration that the large sample size may influence the results, the Mantel χ^2 statistic findings reduced those concerns. Furthermore, additional items that were initially flagged for DIF lacked convincing evidence to indicate a significant difference between the full and adjusted SUBS that warranted item removal from the instrument. Specifically, no discernible pattern based on the item content, phrasing, or wording was identified. Based on a holistic evaluation of the sources of evidence and consideration of conceptual importance of the items flagged for DIF, the research team and I removed the SUBS 6 and treat the remaining SUBS items as the final unidimensional instrument. Despite this decision, there remains sufficient evidence that the proposed items on the SUBS may perform differently when used to measure sense of belonging among postsecondary students, specifically when student residency in on-campus housing or participation in residential programs (i.e., LLP) are considered.

Findings from the measurement invariance testing on the SUBS flagged several items for DIF (i.e., SUBS 4, SUBS 6, and SUBS 7), but ultimately only one offending item, SUBS6, had convincing evidence to warrant removal due to local item dependency issues and measurement invariance. SUBS 6 ("Professors in my classes care if I am absent") may suggest that student relationships with professors may differ among different groups as an indicator of students' sense of belonging. In this case, a sizable DIF contrast (-1.70) on SUBS 6 for students who participated in LLPs and those who did not suggest this relationship to instructors may be experienced differently. Slaten et al. (2018) recognized the influence of the student-faculty relationship by including a specific subscale in their instrument.

No discernible pattern based on the item content, phrasing, or wording was identified with items other than SUBS 6. This led to the decision to maintain as many of the items as possible, despite the isolated instances of local item dependence or measurement invariance. The detection of DIF among several items were concerning, but less concerning than the detection of DIF on most or all of the items when specific groups were compared. Other items that exhibited DIF emphasized differences between on- and off-campus student residents and LLP participants and those who are not, totaling to eight of the nine SUBS items flagged for DIF for these comparison groups. Different degree level types (i.e., undergraduate and graduate/professional) also showed DIF on several items.

Overall, DIF was detected on a number of items across several of groupings. It was clear that the residential component of the higher education experience was an influential factor on postsecondary students' sense of belonging, as was the level of degree being pursued (i.e., undergraduate or graduate/professional). These findings reinforce the reciprocal deterministic relationship described by SCT (Bandura, 1986) that personal beliefs (i.e., sense of belonging), behaviors (i.e., social and academic experiences), and environment (i.e., residential living) influence one another. The number of items flagged for DIF when comparing responses from postsecondary students who reside in on-campus housing and those who do not may not be appropriately measured using the SUBS. Although on SUBS 6 was removed, these findings further limit our ability to make comparisons across groups.

Currently, the SUBS is an untenable instrument of postsecondary students' sense of belonging based on concerns about internal structure and model-data fit. The initial

investigations into adjusted versions of the SUBS (i.e., removal of SUBS 6 and removal of SUBS 4, 6, and 7) were improvements, but require further testing. Like other instruments of this elusive construct, it is imperfect. But unlike other instruments, the process of developing the SUBS was promising and more intentional. First, it is specifically developed and field-tested for use among postsecondary students. Second, it is an instrument that incorporates the strengths of Goodenow's (1993b) conceptual alignment to the construct of students' sense of belonging, Slaten et al.'s (2018) contextual specificity of the postsecondary experience, and Whiting et al.'s (2018) brief, yet sophisticated item and scale development, subjected to rigorous psychometric assessment.

4.7.4 Limitations

Limitations for this study impact both the interpretation and the design of future work related to the current study. First, the process of adapting the SSBS to develop the SUBS would have been improved with cognitive interviewing (Peterson et al., 2017) and pilot testing (Worthington & Whitaker, 2006). This was a collective oversight by the research team. To ensure that these items were interpreted as intended when adapted for use with college students at higher education institutions, these important steps in the scale development process should have been integrated in the scale adaptation process (DeVellis, 2012; Worthington & Whitaker, 2006).

Second, groups in the study sample were dramatically unequal. As a PWI, this was an anticipated limitation that was addressed during data collection, but oversampling efforts were less than effective. Of note, the sample did relatively reflect the gender diversity ratios found in the population at the host university. Despite the collaboration

between the research team and on-campus units, these limitations were present in this study.

The generalizability of this study is limited in two ways. One, the results are sample dependent. This was a study conducted on a university campus of a particular profile: large, land-grant, research, PWI in Southeastern United States. Although the SUBS was developed for use with a broad range of postsecondary students from diverse backgrounds, the findings from this study are limited by the convenient sample of postsecondary students that participated in the data collection. This has been an expressed concern by researchers for as long sense of belonging has been studied in schools (e.g., Hurtado & Carter, 1997, Strayhorn, 2012). Two, our research team decided during the data analysis phase to collapse the categories from four response options to two based preliminary inspection using the Rasch measurement model. This data-driven decision is a legitimate option that similar studies have enacted (e.g., Chang & Englehard, 2016; Toland & Usher, 2016), but cost the study an opportunity for different, more robust analysis available to polytomous data in the Rasch measurement model approach.

4.7.5 Future Research

Although the research on students sense of belonging has two decades worth of scholarly work, this line of inquiry has only recently shifted attention toward the postsecondary student level (Slaten et al., 2016). This opens an avenue for researchers and practitioners who are interested in contributing advancements in the conceptualization, measurement, and intervention of this elusive construct. One avenue of future research could be a direct extension of brief instruments, the one proposed in this current study, that not adapted, but developed, through a rigorous scale development

process that fully captures the postsecondary student experience with the construct of sense of belonging. Although the UBQ is lengthy, the scale development process and psychometric investigations that Slaten et al. (2018) conducted provides a blueprint for future instruments that can be used to develop instruments with the simplicity and sophistication of Whiting et al.'s (2018) SSBS.

As researchers and practitioners deepen our understanding of the construct of sense of belonging, the experience of specific groups in higher education can benefit from research specific to their experience. For example, graduate and professional students' sense of belonging should be further investigated as the experience is different by curricular design and may not be appropriate to assess using the same instrument. Findings from the measurement invariance testing in this study provide support for this specific research path. Future directions related to group differences should address the complexities of measuring students' sense of belonging among diverse student populations (e.g., Hurtado & Carter, 1997; Strayhorn, 2012; Vaccaro et al., 2015), identifying modern data collection and measurement techniques that could be integrated into the study design and scale development. Understanding that sample sizes of postsecondary students who are part of minoritized and marginalized groups are limited, alternative study designs should be considered to capture their experience in higher education institutions.

Despite being a uniquely particular line of inquiry, more attention is required on the study of students' sense of belonging based on participation in LLPs and on-campus residency, as evidenced by findings from measurement invariance testing in this study. Even with the omission of offending items (i.e., SUBS 4, 6, and 7), these students'

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groupings persisted in demonstrating DIF on items that did not exhibit DIF when compared for other student groups. Furthermore, SUBS 3 (I am included in lots of activities at [University]) was ranked through the Rasch measurement model approach that it was the most difficult item to endorse. The engagement of students at universities could be specifically researched since this is an indicator that directly questions engagement opportunities for students—specifically students that belong to underrepresented minority, off-campus, and non-LLP communities—to develop a sense of belonging. A further study of the experience of those who are part of LLPs or those who do not live on campus would provide further insight on the differences between experiences within universities that may influence the persistence and graduation in a significant way (Brooks, 2010; Strayhorn, 2012).

New studies to pursue distinct lines of research to understand sense of belonging with postsecondary students should be pursued to continue the current momentum. Study replications should also be pursued, since measurement techniques and psychometric methods have improved rapidly over the course of the two decades that sense of belonging has been studied. Although consultation with partners from the university led to the decision of dropping the item "People here notice when I am good at something" from the instrument, responses to this item should be collected along with the other items adapted from the SSBS (Whiting et al., 2018). The inclusion of this item would provide a more direct adaptation of the instrument for a higher education context and provide an opportunity for to make decisions about the omission of this item based on item characteristics, rather than solely based on practitioner opinion. Furthermore, the responses collected on the SUBS elicit additional questions about how this construct is

uniquely experienced at college and universities. For example, the content of SUBS 6—regarding professors' cognizance of student presence—questions the influence of instructors on a students' sense of belonging. Furthermore, sense of belonging in higher education may be influenced less by the institution level, but rather the course level. This would be an important, yet anecdotally supported, divergence from the SSBS (Whiting et al., 2018). Last, future studies can explore the implications of online learning on postsecondary students' sense of belonging (e.g., Decker & Beltran, 2016; O'Shea et al., 2015; Thomas et al., 2014). By committing dedicated scholarly efforts toward understanding sense of belonging at this academic level, these higher education specific questions can be tested. Furthermore, models like Tinto's (2017) model of student retention, persistence, and graduation can guide these empirical explorations beyond improved measurement.

4.8   Conclusion

The SUBS, a new instrument to measure postsecondary students' sense of belonging was introduced in this study and field tested through the Rasch measurement model (1960) approach for unidimensionality, local item dependence, model-data fit, and invariance. The current study provided evidence for the unidimensional interpretation of data collected with the SUBS. Similar to Whiting et al.'s (2018) SSBS instrument that was adapted to develop the items on the SUBS, invariance testing was conducted and DIF across gender and ethnic groups was found negligible. DIF was detected during the comparative assessment of responses collected from undergraduates and graduate/professional postsecondary students, as well as students who live on campus and in LLPs compared to those who do not. One item, SUBS 6, was found problematic and

removed from the final instrument, reducing the SUBS to an 8-item instrument. The SUBS could be further reduced to 6 items if the DIF present in SUBS 4 and 7 were removed. However, these items were maintained because of their negligible contributions to an improved instrument and the perceived importance of the content based on related literature and consultation with university partners.

The SUBS may be an imperfect instrument, but it is unlike other instruments. This study and the proposed instrument shuttle the development of future brief, robust instruments intended for use at the higher education level. Additionally, it promotes conversations about the construct conceptualization and measurement of sense of belonging that has been building for decades. By following the charge by Martinková et al. (2017) to prioritize the detection of bias during measurement, this shifts the focus from widespread generalizability to the stories that have yet to be told about how postsecondary students from diverse groups, often minoritized and marginalized across college and university campuses, experience sense of belonging. This simple instrument to measure belonging asks complicated questions about the differences in experience that can occur at the same institution, simply because the student is a female, or Black, or does not live on campus. These are experiences that should be valued and captured in the research—especially if that research is intended to support decision and policy making at higher education institutions that affect all postsecondary students.

As higher education institutions continue to respond to both market demands and student needs, students' sense of belonging will play a growing role in the satisfaction, achievement, and retention of students at higher education institutions. Regardless of student groupings, sense of belonging will continue to garner attention at higher

education intuitions. Belonging is an elusive and loosely defined construct, which makes the measurement of sense of belonging more difficult. Should surveys, questionnaires, and other instruments continue to be the methodology of choice to gauge if students belonging at their colleges and universities, it is imperative to understand and address the theoretical and measurement issues that may inflate or inaccurately portray the postsecondary student experience, producing results that stakeholders are closely monitoring to develop initiatives and interventions. And although higher education parents, researchers, and leaders may be paying attention to this construct, ultimately, students are the ones who pay the massive cost when their sense of belonging suffers. All those interested in students' sense of belonging would benefit from extending this work to include predictors, covariates, and outcomes that provide a holistic view of belonging in higher education institutions to move forward with accurate measurement and into modeling how sense of belonging is experienced as part of a dynamic, complicated psychosocial system at this academic level.

4.9   References

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CHAPTER 5. THE BRIEF COURSE BELONGING SCALE: DEVELOPING A MEASURE OF POSTSECONDARY STUDENTS' COURSE-LEVEL SENSE OF BELONGING ACROSS ONLINE & FACE-TO-FACE COURSE DELIVERY CONTEXTS (STUDY 2)

A growing trend in higher education is to offer courses, as well as complete degree programs, in fully online contexts as an alternative to or extension of face-to-face educational opportunities. Furthermore, sociocultural events—specifically the onset of the global pandemic during the Spring semester of 2020—have forced education at all levels to temporarily move instruction online. Currently, the conversation is no longer about the option of online learning, but rather the reality and opportunities presented by fully online courses and programs to improve students' educational experience. Although higher education is venturing rapidly toward more online options (AACSU, 2019), issues of student persistence, retention, and graduation remain. One of the pathways to ensure postsecondary students' retention and persistence to degree completion is to address their sense of belonging. Both conceptual and empirical work provide evidence that sense of belonging influences student success (e.g., Hausmann et al., 2007; Hurtado & Carter, 1997; Tinto, 2017). Despite this advancement, investigating postsecondary students' sense of belonging in the online learning context is limited. In addition, sense of belonging has been more commonly measured as characteristics at the institution (i.e., school or university) level (e.g., Pittman & Richmond, 2008; Slaten et al., 2016), even though this construct was originated at the classroom level to reflect the relational aspect of students' sense of belonging amongst one another (Goodenow, 1993a).

Only a few studies have been conducted to investigate postsecondary students' sense of belonging at the course level and in the online learning context; even fewer are quantitative by design (see Decker & Beltran, 2016; Hewson, 2018). Quantitative

instruments have been developed to measure postsecondary students' sense of belonging (e.g., Slaten et al., 2018), however, existing instruments were not developed with the intention of measuring sense of belonging to other students in an online course. Current instruments have not been field tested with postsecondary students completing their degree in fully online learning courses or programs while living at a distance from the physical campus environment. Moreover, there is a lack of evidence that any instrument is able to produce comparable scores that allow for the investigation of differences in students' sense of belonging to other students based on learning context (i.e., fully online learning versus fully face-to-face courses or programs). Based on these concerns and in response to evolving academic opportunities, an instrument to measure postsecondary students' sense of belonging to other students in across learning contexts is an in-demand extension to fill the current gap in the literature.

5.1   Background

Sense of belonging among postsecondary students have been associated with persistence, retention, and graduation (Tinto, 2017)—key metrics of student success closely attended to by higher education institutions. Despite two decades of research on postsecondary students' sense of belonging, this construct remains a conceptually elusive and difficult construct to measure due to constant advancements in higher education (Slaten et al., 2018).

Early conceptualization of this construct can be attributed to foundational human motivation theory developed by Maslow (1943), who explained that belonging influences the achievement of positive esteem of self and others, and essential for individuals to ultimately achieve self-actualization. More contemporary understanding of this construct

is rooted in the "belongingness hypothesis" (Baumeister & Leary, 1995, p. 500), that proposes two attributes: maintained and frequent conflict-free interaction with others, as well as committed, stable, and genuine bonds. According to the belonging hypothesis, one can satisfy their need for belonging by participating in lasting interpersonal relationships based on shared regard and concern.

Within the educational experience, students' sense of belonging has been described as "being accepted, valued, included, and encouraged by others…feeling oneself to be an important part of the life and activity of the class" (Goodenow, 1993a, p. 25). Goodenow (1993b) further explained that a sense of belonging in a learning context is "the extent to which students feel personally accepted, respected, included, and supported by others in the school social environment" (p. 80). Extending the work of these scholars, Walton and Brady (2017) defined sense of belonging as a "feeling of being accepted, included, respected in, and contributing to a setting" (p. 272). Although these definitions similarly identify the relational nature of the construct as experienced by individuals, there remains scholarly discrepancies about the nature and uniform definition of students' sense of belonging.

More specifically, this construct has been evidenced to influence student well-being and achievement, such as academic motivation and social connectedness (e.g., Beatty & Brew, 2005; Francis et al., 2019; Kosovich et al., 2015). Alternatively, the absence of a sense of belonging has been associated with loneliness, depression and disengagement, as well as feelings of invisibility, shyness, and devaluation (e.g., Cockshaw & Shochet, 2010; Gunn et al., 2012; MacDonald & Leary, 2005). With growing interest in the relationship between sense of belonging and postsecondary

student success, applied researchers have expanded the body of literature into different developmental stages and educational levels, attempting to capture the experiences of all types of students in relation to this construct (e.g., Goodenow, 1993a; Hurtado & Carter, 1997; Lewis et al., 2019; Slaten et al., 2018; Tinto, 2017). Additionally, this suggest that the academic environment, in general, influences how students experience sense of belonging. Even though students may be assumed to share similar experiences with their institutional peers, there may be unexpected group differences that would lead to differences in students' sense of belonging.

5.1.1 Group Differences and Sense of Belonging

Differences in experiences of belonging, specifically in higher education, remain an issue with increasing complexity (Hurtado & Carter, 1997; Strayhorn, 2012). This disparity has been evidenced through research with students from marginalized and minoritized groups (Stebleton et al., 2014; Vaccaro & Newman, 2016). Additionally, the intersectionality of identities furthers the complexity of postsecondary student sense of belonging (e.g., Hernández et al., 2017; Lewis et al., 2019; Mejias et al., 2014). For example, Strayhorn et al. (2010) reported that students who identified as Black gay males reported that sense of belonging was a major challenge during their time at predominantly White institutions (PWIs). Although campus wide efforts to increase sense of belonging may be geared towards the entire student population, researchers recommend that minoritized and marginalized students require closer attention due to their susceptibility to drop out, fail, or not even begin college at all (e.g., Gummadam et al., 2016; Museus et al., 2018; Strayhorn, 2012).

However, this experience is not limited to students from marginalized gender, ethnic, ability, and socio-economic groups (e.g., Decker & Beltran, 2016; Hussain & Jones, 2019; Vaccaro et al., 2015; Vaccaro & Newman, 2017). Differences in experiences can extend to students who are not part of the mainstream student profile, such as military veterans and off-campus residents. Specifically, the variety of learning contexts (i.e., face-to-face, online, and hybrid courses; Allen & Seaman, 2013), increases the potential of marginalizing more students, especially those that are already from vulnerable demographic groups. Since distance education programs receive less support and resources, students who are fully online are particularly susceptible to being disadvantaged (e.g., Peacock & Cowan, 2018; O'Shea et al., 2015). Furthermore, rapidly increasing effort to move higher education into online learning contexts further complicates how sense of belonging is fostered.

Addressing these important issues of equity related to sense of belonging due to the educational environment, specifically the online learning context, at higher education institutions may better improve enrollment, achievement, and retention outcomes.

5.1.2   Sense of Belonging in Online Learning Contexts

Investigating postsecondary online students' sense of belonging is concerningly limited, given the rapid expansion into online learning contexts. Researchers have identified that students who are enrolled in fully online courses and programs desire to feel a sense of belonging in the online learning contexts before attending to academic duties (Peacock & Cowan, 2018). Additionally, fully online students deliberately seek opportunities to interact with others beyond basic engagement to compensate for a lack of physical presence (e.g., Delahunty et al., 2014). Hewson (2018) identified unintended

negative psychological effects of the online learning experience, which include anxiety, stress, guilt, and hyper-competitiveness. O'Shea et al. (2015) reported that "online learners identifying themselves as 'second-class citizens' or 'just an online student'" (p. 55). Unexpectedly, rather than making higher education more accessible, online learning may isolate and stifle the social and academic experience of vulnerable students (Hewson, 2018; O'Shea et al., 2015). To be sure, face-to-face contexts elicit similar psychological reactions, but the variability between the two learning contexts might be more nuanced than currently understood. Online learning contexts present opportunities for instructors to attend to these issues resulting from the online learning context, including students' sense of belonging (e.g., Bautista & Escofet, 2015; Thomas et al., 2014). Understanding postsecondary students' sense of belonging—and the measurement of the construct—in both online and face-to-face learning contexts subsequently improves the academic experiences for all students.

5.1.3 Measuring Postsecondary Students' Sense of Belonging

The use of existing instruments to measure students' sense of belonging has recently gained momentum at the postsecondary level as higher education institutions deliberately addressed sense of belonging to address student retention issues (e.g., Angelino et al., 2007; Slaten et al., 2018). Despite efforts to improve students' sense of belonging in postsecondary settings, there is a gap in the available instruments for this construct. Existing instruments (i.e., Hoffman et al., 2002; Slaten et al., 2018) are widely used, but have been presented with limited validity evidence (i.e., dimensionality, internal, correlational). Several studies have recognized the importance of measuring this complex construct, but the most commonly used—Goodenow's (1993b) Psychological

Sense of School Membership (PSSM)—focuses on adolescent students. Although the PSSM is a popular choice for sense of belonging research, concerns over the psychometric qualities of this instrument have been presented (You et al., 2011). Alternative instruments with improved psychometric qualities have been developed (Slaten et al., 2018; Whiting et al., 2018). However, a brief one-factor instrument does not exist for use specifically with postsecondary students. Despite the rapid growth of online course offerings, existing instruments have not been developed nor field-tested with students taking courses and studying in an online environment. Only few studies address this distinct issue (e.g., Decker & Beltran, 2016; Hewson, 2018). More pressing, the existing instruments were not developed with the intention of measuring sense of belonging in an online course or for use with postsecondary students completing their degree in a fully online learning program while living at a distance from the physical campus environment. Ultimately, the development of robust instruments to measure postsecondary students' sense of belonging can only help higher education institutions address contemporary issues, including the growing demand for online education.

5.2   Theoretical Framework

This investigation is situated in two concurrent frameworks. Social Cognitive Theory (SCT) presents a model that accounts for the relationships between personal, environmental, and behavioral factors and the "mutual action between causal factors" (Bandura, 1986, p. 24). For instance, the perceptions students might have about their sense of belonging in an online course can influence their participation and engagement. In this view, each factor has an impact on the other two and changes in strength depend on the constraints of the situation (e.g., familiarity with online instruction, engagement

with peers). Bandura states that "environments provide an especially wide latitude for creating conditions that can have a reciprocal effect on one's own behavior" (p. 29).

These influential factors identified in SCT are best understood through models designed for applied context. Specifically, Tinto's (1987) model of student retention highlights the influential role of higher education institutions to ensure student success. An update in 2017 extended this model from the institution to the student perspective. The 2017 model incorporates sense of belonging as a key construct, along with students' self-efficacy and perceptions of the curriculum. According to Tinto, sense of belonging is the perception that one matters to a community and that ones' participation is valued. Sense of belonging, Tinto explains, maintains and enhances motivation, thus avoiding attrition from postsecondary education. He proposes that students' sense of belonging, and its relationship with self-efficacy and perceptions of the curriculum, comprises a students' motivation to persist towards achievement goals.

Together, these two theoretical frameworks integrate the developmental motivation of learners with the unique context of learning at a postsecondary level. This dynamic consideration of the two frameworks recognizes the complexity of individual and institutional factors to best understand how sense of belonging is conceptualized for postsecondary students and its influence on learning behaviors.

5.2.1   Bandura's Social Cognitive Theory

Considering a students' sense of belonging, the learning context, and the influence it may have on achievement and retention requires a theoretical framework that encompasses personal, environmental, and behavioral factors. Bandura's theory emphasizes the bidirectional relationship of behavioral and personal factors and

incorporates the environmental factors of postsecondary education. SCT (Bandura, 1986) is based on a theoretical framework that bridges the behavioral factors of student achievement (i.e., retention), environmental factors of the academic context (i.e., course level context), and personal factors of students' beliefs (i.e., sense of belonging), complimentary to Tinto's model that recognizes the relationship between student perceptions and progress towards graduation.

5.2.2 Tinto's Model of Retention

The current study is not only appropriately situated in SCT, but in Tinto's conceptual framework as well. Tinto's (1975) original framework highlighted issues concerning retention, or the sustained enrollment and integration of students into postsecondary institutions. His framework is based on postsecondary students persisting through the difficulties of higher education. According to Tinto, this is best achieved by ensuring fit between the individual and the institution. From the previous research studies on retention based on Tinto's original model, one particular construct—students' sense of belonging—has become a key construct identified repeatedly and throughout. His framework emphasized the need in higher education to belong to a group and authentically connecting to a community in order to maintain matriculated until graduation. Although critiqued for its limitation, this model was the catalyst for an extensive body of research (Seidman, 2005). Tinto updated his model in 2017, incorporating the perspective of the individual (i.e., postsecondary students) in relation to the institution. The updated model situates a postsecondary experience by associating those personal factors with a students' motivation which is influenced by their goals and influences their persistence (i.e., retention). Tinto identified the bidirectional relationship

of sense of belonging on perceptions of curriculum and the influence of self-efficacy on sense of belonging and environmental factor, such as online and face-to-face learning contexts, are important.

5.3   Purpose of Study

          This study proposes the development and psychometric evaluation of a new unidimensional instrument to measure postsecondary students' sense of belonging to other students within the same course. The proposed instrument in this study is the Brief Course Belonging Scale, or BCBS. The BCBS was specifically developed for use among postsecondary students in both online and face-to-face course delivery contexts and developed in accordance with the measurement guidelines presented by AERA, APA, and NCME (2014). In this study, online students were considered postsecondary students who enrolled in online courses and learned from a distance from the university. Face-to-face students were considered postsecondary students who attended classes on the physical campus of the university. The items on the BCBS were sourced from qualitative data original to this study, as well as information from existing measurement research on sense of belonging (Goodenow, 1993b; Slaten et al., 2018; Whiting et al., 2018). By contributing the BCBS, this study extends the research on students' sense of belonging to include course-specific measurement, accounting for course delivery context.

          An exploratory sequential mixed methods design (i.e., QUAL[quan] $\rightarrow$ QUAN; Creswell & Plano Clark, 2018) was employed. Briefly, Phase 1 of this study focused on instrument development, which involved collecting qualitative data to inform an iterative item writing and expert review process, followed by cognitive interviewing. Then, the psychometric investigation of the BCBS was conducted through Phase 2, in which

evidence was gathered to confirm the unidimensionality of the BCBS and determine differential item functioning (DIF) on responses across course delivery contexts. This psychometric evaluation concludes with Phase 3, where data from additional measures of related constructs were collected to establish validity evidence.

The instrument development process and scale and item-level analyses was intended to address the following research questions (RQ) to determine if the items on the proposed BCBS can be used to measure sense of belonging to other students within the same course across both online and face-to-face contexts. The RQs include:

RQ1: How do online and face-to-face postsecondary students define sense of belonging to other students within the same course?

RQ2: Does the factor and internal structure of the data provide evidence that items from the BCBS behave similarly across online and face-to-face course delivery contexts?

RQ3: What evidence can be gathered from the data to compare postsecondary students' sense of belonging to other students within the same course based on course delivery context?

In addition to the data collected on the BCBS, convergent and discriminant validity evidence was gathered from related constructs (i.e., sense of belonging at the university level [Slaten et al., 2018], academic motivation [Kosovich et al., 2015], social connectedness [Beatty & Brew, 2005], and loneliness [Russell et al., 1980]). Based on previous literature, postsecondary students' sense of belonging to other students within the same course is expected to (a) have the strongest positive correlation with sense of belonging at the university level, as well as connectedness (Slaten et al., 2018; Whiting et

al., 2018); (b) exhibit a medium to strong positive correlation with academic motivation (Francis et al., 2019); and (c) exhibit the weakest negative correlation with loneliness (Slaten et al., 2018).

It is consequential to measure students' sense of belonging to other students within the same course using a fair and reliable instrument that is relieved of potential issues of validity based on group differences, such as course delivery context, that could prevent appropriate and defensible claims about interpretation. Bandalos (2018) stated that "If unintended consequences are found, researchers should determine, to the degree possible, whether these are due to sources of test invalidity such as test irrelevance or construct underrepresentation" (p. 296). By constructing and evaluating sense of belonging instruments that are context specific, like the BCBS, researchers and practitioners alike can ensure fair measurement and better understand how to measure this construct in online and face-to-face contexts.

5.4   Study Setting

All three phases were conducted at a predominantly White institution (PWI), with 67% of the student body identifying as White/Caucasian and a slight majority (58%) of female representation (Appendix Table B1). The host institution offered a robust selection of courses and program degrees as fully online opportunities. Additionally, the partner offices (i.e., IR, SAL, and TLAI) were interested in learning more about the experience of enrolled students, specifically, how students perceived their sense of belonging to other students in their courses. Data were collected in partnership with the Institutional Research (IR), Student and Academic Life (SAL), and Teaching, Learning and Academic Innovation (TLAI) university units. Based on consultation with IR, an

intricate sampling design and inclusion criteria was established to reflect the typical participation rates at the university and student characteristics of both the online and face-to-face student populations.

5.4.1   Course and Student Inclusion Criteria

Students from the university were invited to participate in this study based on inclusion criteria developed in partnership with IR. First, eligible courses were selected, which excluded hybrid courses. To include only fully online and only fully face-to-face students, only courses active at the time of data collection were sampled and certain types of classes were excluded, such experiential learning (internships, co-ops), study abroad, thesis and dissertation writing, and compressed video. Additionally, only sections that had more than five students were included. Courses from both contexts were then matched by course characteristics, based on class (e.g., MA 109 face-to-face and MA 109 online), level (e.g., 100- and 200-level courses), department, and college.

Then, eligible students were selected. Online students were classified as those who were seeking a degree from a fully online program, learning from a distance. Face-to-face students were classified as those who were seeking a degree from a traditional program, attending classes on the physical campus of the university. Students could only appear in the participant pool once, even if they were enrolled in more than one of the courses that met the inclusion criteria (see Appendix Table B2).

The data collection process was designed to gather qualitative information from interviews as well as self-reported quantitative data, with an iterative item writing and scale development process bridging the two methods. The phases, activities, and timeline

for this study based on the exploratory sequential mixed methods design by Creswell and

Plano Clark (2018) is summarized in Figure 5.1.

Figure 5.1

Study Design Plan

FOCUS GROUP INTERVIEWS THEMATIC ANALYSIS & INITIAL ITEM WRITING → EXPERT REVIEW 1 ITEM REVISION → COGNITIVE INTERVIEWS ITEM REVISION → EXPERT REVIEW 2

Fall 2019 — Content — *Postsecondary students (Target audience)* — Method/Field

QUAL PHASE 1 Postsecondary students (Random)

ITEMS & SCALE FINALIZATION → DATA COLLECTION → DATA ANALYSIS

QUANT PHASE 2 & 3 *March 2020* — *April 2020* Postsecondary students (Random) — *May 2020*

5.5   Phase 1: Qualitative Data Collection and Instrument Development

Phase 1 addressed RQ1 through a qualitative approach, intended to explore

postsecondary students' descriptions of their sense of belonging in online and face-to-

face courses by identifying general themes associated with perceptions of positive

interactions and relationships and the stability of those relationships with others

(Baumeister & Leary, 1995). Following thematic analyses of the focus group responses,

an initial pool of items was developed based on themes established through the open-

ended responses and an analysis of existing sense of belonging instruments. Research

team members provided feedback on the sentence structure, vocabulary, and clarity of the

draft items. Item writing guidelines presented by scale development methodologists

(DeVellis, 2012; Kline, 2016; Price, 2017) were used to eliminate or revise the pool of

items. Expert reviews and cognitive interviewing followed, with the iterative item revision continuing until a final set of items were determined for the BCBS.

5.5.1   Data Collection

The qualitative data collection informed both the definition of sense of belonging at a course level for RQ1, as well as iterative item writing and scale development. This phase required the recruitment of two distinct focus groups to understand how postsecondary students define sense of belonging in the different course delivery contexts of interest (i.e., online, face-to-face). Blair and Conrad (2011) highlight benefits of larger focus groups (i.e., more than 75 participants), but also stated that "although many problems that are undiscovered at smaller sample sizes are identified with larger samples, the efficiency of subsequent interviews in finding new problems decreases as sample size grows large" (p. 651).

5.5.1.1   Focus Groups

Open-ended responses were collected from a convenience sample of participants who responded to an invitation to a focus group about their personal experiences in their courses. An Appreciative Inquiry framework guided the questions asked, which was a suitable match for this study since the data collected will be used for program improvement at the host university. Patton (2003) highlighted the strength of this approach as integrated inquiry and action, with the "very nature of the questions asked and the assets-oriented framework used" (p. 88) useful for projects that require "a combination of credibility, sensitivity, and honesty" (p. 91) to capture experiences for programmatic change and not just data analysis.

Five open-ended questions were asked. Participants were provided an unlimited amount of time to respond. First, focus group participants were asked about their personal definition of belonging. To gain specific details about their personal definition, participants were prompted to apply their personal definition of belonging by describing their own sense of belonging in the context of their courses. Then, participants shared a specific instance or moment of belonging to elicit details about belonging in their courses. Participants were asked to elaborate further by identifying factors that may have influenced their perceptions in those experiences. These two questions were used to harvest statements about (un)stable relationships and positive/negative interactions associated with manifestations of belonging as theorized by Baumeister and Leary (1995). As an opportunity to highlight existing practices, as well as identify future improvements, participants were asked to detail any actions that may be taken to improve students' sense of belonging at the host university. The focus group protocol can be found in Appendix Table B3.

One group included students who were enrolled in fully online programs ($n = 17$) offered by the host university and the other group of a distinct set of students enrolled in fully face-to-face programs ($n = 13$). Focus groups for online students were conducted through a web-based communications platform (Zoom) and focus groups for face-to-face students were conducted in person on the university campus.

5.5.1.2   Expert Reviews

Following the focus groups, the instrument development process began with draft items for review by purposefully selected content and field experts followed by cognitive interviewing with the target audience (Peterson et al., 2017; Worthington & Whitaker,

2006). This extended, iterative process to revise items that incorporated different sources of feedback (Saldaña, 2016) was necessary to achieve a unidimensional instrument of postsecondary students' sense of belonging to other students within online and face-to-face courses. This expert review process was conducted to incorporate feedback from scholars who have conducted research on the construct of sense of belonging, higher education and postsecondary students, and/or applied psychometric techniques (DeVellis, 2016). Following guidelines by Rubio et al. (2003), each expert completed a review of the draft items. Item quality evaluation included a rating for clarity and a decision based on construct relevance, as well as an open-response question for additional comments. Item phrasing clarity was rated using a 4-point Likert-type scale: *not at all clear*, *a little clear*, *somewhat clear*, and *completely clear*. Raters were also asked to choose whether to *keep*, *revise*, or *drop* (i.e., remove) each item by considering how important each item was to the measurement of students' sense of belonging. Feedback was also provided on the instructions and response options.

Educational and psychological content experts ($N = 10$) were asked to review the reduced pool of items that were included in the proposed instrument. After items were revised based on received content expert feedback ($n = 5$), cognitive interviewing with a distinct sample of postsecondary students was conducted. Following cognitive interviewing with students from the target audience and subsequent item revisions, a second round of expert review ($N = 12$) were consulted for feedback. Field experts ($n = 8$) were higher education professionals from the host university who work directly with postsecondary students and were specifically selected to represent a diverse range of gender, race/ethnic group, and professional identities. The disciplines, fields, and

demographics represented by expert reviewers during this iterative item development process are provided in Appendix Table B4.

5.5.1.3 Cognitive Interviews

Cognitive interviewing included a unique group of students who have experience with both contexts. These students were specifically recruited as the target audience for the BCBS since most students would have experienced both types of contexts, even if they are currently enrolled in either an online or a face-to-face course. Cognitive interviews were completed before the BCBS was sent to a final round of expert review.

Cognitive interviews (Peterson et al., 2017) were conducted with a convenience sample of postsecondary students ($N = 6$) who had experienced both online and face-to-face courses since these students reflect the target audience. To determine any discrepancy between the item phrasing and the interpretation of the respondent (Peterson et al., 2017), a cognitive interview protocol was established which included an open-response opportunity to describe the clarity of the item and to provide feedback on construct relevance, as experienced by the participant.

Cognitive interviews were held through a web-based communications platform that allowed for screen sharing. Each item was displayed on the screen for the student, followed by a prompt for them to provide open-ended responses to their interpretation of the item, specifically commenting on the clarity of the item. Any recommendations for item revision were also solicited as part of the cognitive interview. Feedback was also provided on the instructions and response options.

5.5.2   Data Analysis

To determine how online and face-to-face postsecondary students define sense of belonging to other students within the same course (RQ1), qualitative responses for the focus groups were collected and analyzed using Microsoft Excel 2016. A spreadsheet was used to organize segments of each open-ended response during the initial data collection, calculate inter-rater agreement during the calibration process, and track and assign codes for each open-ended response. Inter-rater agreement was estimated using Krippendorff's alpha coefficient (Hayes & Krippendorff, 2007), which evaluates calibration between multiple raters and used with any level of measurement.

5.5.2.1   Focus Groups

Open-ended responses provided by focus group participants was analyzed through a cyclical coding process to reach thematic agreement between the research team members (Saldaña, 2016). I, along with trained coders in the research team, independently coded segments of the open-ended responses. This process was conducted separately for each question presented to the participants. The coding list was refined based on discussions between the researchers to identify (a) frequently used codes and (b) descriptive codes reflected in the responses that did not exist in the original coding list.

Under my training, the coders first participated in a calibration round using the refined list of codes, independently coding a sample of open-ended responses using Microsoft Excel. The coders discussed the discrepancies in coding and refined the list of codes to capture the thematic patterns in the responses. After a second round of independent practice with this set and agreement between the trained coders that no

further modifications needed to be made to the current coding list, detailed definitions and example quotes were finalized to create a coding guide.

Using the finalized coding guide, the coders and I independently coded the responses to all five questions. Two coders were assigned to each context group. The coders were given an opportunity to provide a secondary code if more than one code applied to the statement provided by the focus groups participants. Complex responses were discussed by the pairs and a final code assignment was determined by consensus.

5.5.2.2   Expert Reviews

The feedback received from experts were examined, and any items that were recommended to be revised or removed by two or more reviewers were flagged for evaluation. Evaluation included a review of clarity ratings of "not at all clear" or "a little clear" or "somewhat clear" and any unclear items flagged by two or more reviewers were revised based on the open-response comments and revisiting of the focus group responses and thematic analysis.

5.5.2.3   Cognitive Interviews

The feedback received from students were considered for direct item revision. Cognitive interviews were conducted to saturation and common responses across the interview sessions were reflected in the refinement of items until the intended meaning was clearly communicated by students during the interview. Cognitive interviews were documented as discussions and the analysis of these responses were not subject to any degree of quantification.

5.5.3 Results

5.5.3.1 Focus Groups

From the focus groups conducted, a total of 211 segments about postsecondary students' sense of belonging to others within the same course were coded by members of the research team that I trained. Specifically from the online focus groups, 133 segments were collected, and 78 segments were specifically collected from the face-to-face focus group sessions. Thematic analysis of these segments resulted in ten major themes, summarized in Appendix Table B5. These themes reflect responses that refer to relationships, experiences, and expectations, as well as psychological and resource needs that influence sense of belonging. After discussing the common themes, a code list was developed with eleven codes that best reflected the focus group responses. The final code list, definitions, and example responses is summarized in Table 5.1 The code list was determined with a careful balance of specificity that captures facets of course-level sense of belonging, as well as broad applicability across online and face-to-face contexts.

Table 5.1

Finalized Qualitative Codes with Definitions and Example Quotes Based on Thematic Analysis of Focus Group Responses

Code and definition	Example quote
Feeling supported Having the perception that peers and/or instructors are expecting successful outcomes despite potential failures, mistakes, and other opportunities for judgement and negative criticism	"...you feel like you can openly communicate with and not feel like you're going to be rejected."

Table 5.1 (continued)

Code and definition	Example quote
Interest in others Being psychologically open to developing personalized interactions with peers and/or instructors	"I want to do some kind of activity to get to know my classmates just because I may need to ask you for the homework, you know like something that helps."
Engaging actively Expending effort and energy to interact with peers and/or instructors	"...interaction between the students and teachers, and it's helped a lot."
Sharing experiences Having common opportunities and interactions that develop bonds	"In terms of like hardship, going through struggles together…you can accomplish more while having other people with you, [rather than] just doing it alone."
Feeling valued Having the perception that individual contributions matter and are important potential failures, mistakes, and other opportunities for judgement and negative criticism	"[On the] fundamental level, not being ignored
Working on collective goals Directing efforts and energy to meet positive expectations beyond personal interests and individual goals	"I mean there's really no more sense of belonging than we keep each other on track with schoolwork, as well as being there for each other"
Nurturing deep relationships Developing bonds with peers and/or instructors that are not solely based on basic or initial relationships	"I also appreciate when professors go the extra mile and reach out and send emails and there have been times where I've missed class and professors have emailed me, like, "Hey, I noticed you were quiet in class. Is everything okay?". And so I think that makes me feel cared for and that contributes to that sense of belonging."
Finding commonalities (interest, goals) Developing bonds based on personal preferences and expectations	"...interact with someone and or group of people and just feel like you have things in common with them.

Table 5.1 (continued)

Code and definition	Example quote
Establishing affiliation Finding a social network or broad community (team, department, college) that reflects some or several aspects of an individual's identity	"...in another sense it's also more powerful because not only have I only been here for three years as an [undergraduate] student at UK, but I've been here and now my graduate degree is also gonna be from UK. So I do feel a greater sense of belonging, to UK, than when I was an undergraduate, but it's through a lot more things now."
Needs reflected Structure and environment are responsive to or compatible with individual needs	"From what I've experienced so far some of my teachers have offered like different methods of learning, which, like you said like not everybody learns the same way so I know some of my professors will hand out like hard copies of notes that you can like actually fill in and that's how I learned this or you can do an online version and take your own notes or just follow the slides or like watch videos"
Adjusting expectations Changing perceptions based on exposure to and experiences with individual and group experiences	"And it's for me it's also a combination of the content and the interactions with the other students and the professor that combined really make me feel tethered, and with a sense of belonging."

Across the online and face-to-face focus groups, three codes were assigned to responses about sense of belonging the most. *Needs Reflected*, *Feeling Supported*, and *Nurturing Deep Relationships* accounted for 12% of assigned codes, with *Needs Reflected* assigned to one response more than the other two codes. Following these codes, *Engaging Actively* and *Interest in Others* were the most frequently assigned codes, accounting for 10% of the codes assigned. All other codes accounted for less than 10% of the remaining responses. These counts and frequencies are summarized in Table 5.2,

which also disaggregates the data by online and face-to-face groups. Inter-rater reliability (IRR) for coding responses from online and face-to-face students was 85% and 81% respectively, meeting the threshold of over 80% IRR on 95% of the data (Miles et al., 2019). As a note, the IRR was based on coding all of the available responses, or 100% of the data.

Table 5.2

Coding Results of Responses during Focus Groups Discussing Postsecondary Students' Sense of Belonging

Code	Online		Face-to-Face		Total	
	n	%	*n*	%	*n*	%
Needs reflected	17	12.8	9	11.5	26	12.3
Feeling supported	15	11.3	10	12.8	25	11.8
Nurturing deep relationships	17	12.8	8	10.3	25	11.8
Engaging actively	13	9.8	8	10.3	21	10.0
Interest in others	15	11.3	5	6.4	20	9.5
Sharing experiences	9	6.8	9	11.5	18	8.5
Feeling valued	9	6.8	8	10.3	17	8.1
Adjusting expectations	6	4.5	8	10.3	14	6.6
Finding commonalities (interest, goals)	10	7.5	4	5.1	14	6.6
Establishing affiliation	11	8.3	2	2.6	13	6.2
Working on collective goals	8	6.0	4	5.1	12	5.7
Two codes	3	2.3	2	2.6	5	2.4
Not coded			1	1.3	1	0.5
Total	133	100.0	78	100.0	211	100.0

Results from the cyclical focus group coding were used to inform the development of items for the Brief Course Belonging Scale (BCBS). An original pool of fifty-eight (58) items were developed to reflect the themes and codes developed during the analysis of the responses collected during the focus group sessions. From the original pool, the items were reduced to twenty items that best reflected the results from the focus

group sessions. FThese items were selected to minimize content overlap and repetition, and sent to expert reviewers for feedback.

5.5.3.2 Expert Reviews

The original 20 items were sent to experts who had published research related to sense of belonging. Seven items were determined to be completely clear statements. 13 items were rated to be related to the construct of sense of belonging to a great extent by two or more of these experts. Only one item (*My contributions matter to other students in this course*), was rated by all experts as completely clear and related to the construct of sense of belonging to a great or very great extent. These 14 items were presented to cognitive interview participants for feedback.

A second round of expert reviews was conducted to further refine the instrument by incorporating feedback from experts who have field and research experience on postsecondary education or expertise in applied psychometrics. From this round of feedback, the 14 items were reduced to 11 items. No revisions were made to six of the items, since those received positive feedback to be included in the instrument as they were currently written. Minor revisions were made on four items to better align with the structure of the approved six, and one item (*I feel like I am more than a stereotype in this course*) was revised to "I feel like other students in this course accept me for who I really am" based on discussions within the research team and in consultation with colleagues in the field.

After the two rounds of expert reviewing, the final 11 items on the BCBS was determined. The revisions to each of the final items are included in Appendix Table B6.

5.5.3.3 Cognitive interviews

Between the two rounds of expert reviews, postsecondary students were consulted after feedback from the construct experts. The 14 proposed items and response options for the BCBS were presented individually and items were maintained, removed, or revised based on the discussion. Most items were maintained or revised, with only three items being recommended for removal. The item "I am comfortable sharing my thoughts with other students in this course." was interpreted to be more specific to the understanding of the course material, rather than the students' sense of belonging. Similarly, the item "Even when I make mistakes, I feel valued in this course" was not associated with sense of belonging, but academic understanding instead. The third item to be removed was causing similar confusion, which was "I am comfortable making a mistake in front of other students in this course." Although these items referred to psychological safety in these courses, the feedback from student participants clearly associated this with academic underperformance and misunderstanding, rather than as an indicator of their sense of belonging.

5.5.4 Discussion

Our study extended the study of postsecondary students' sense of belonging (e.g., Freeman et al., 2007; Hurtado & Carter, 2007; Slaten et al., 2018) by providing empirical evidence—across online and face-to-face course delivery contexts—to support the use and interpretation of scores from a new instrument developed to measure students' sense of belonging with other students in the same course. Our focus groups suggested that online student responses aligned with Maslow's (1943) proposal that sense of belonging

was a defined by the security of the course (e.g., supportive academic environment, clear curricular trajectory), whereas face-to-face student responses suggested sense of belonging was defined by the quality of interactions (e.g., feeling valued, being comfortable to make mistakes, growing relationships through common experiences) as hypothesized by Baumeister and Leary (1995) and Goodenow (1993b). Based on the analyses of responses from both fully online and fully face-to-face students, postsecondary students' sense of belonging with other students within the same course can be defined as perceptions of affirming interpersonal relationships among students informed by interactions in a common, established academic experience. This definition determined from the focus group responses reflect the bidirectional relationships of personal beliefs, behavior, and environment as proposed Bandura (1986), as well as both definitions by Baumeister and Leary (1995) that describe belonging based on relationships and interactions and Goodenow (1993a) who contextualizes it within educational settings.

With the goal of creating a common instrument for use with both course delivery contexts, the tension between the different results of the thematic analysis ascertained from the focus groups was tempered through expert opinions and participant interpretation of the items (Peterson et al., 2017). Although the original pool of items included statements that reflected the sense of belonging as described by both focus group samples, items that were more reflective of the relational definition (as opposed to security-based definition) of students' sense of belonging received more positive feedback as aligned to existing body of knowledge about sense of belonging. Both experts and cognitive interview participants affirmed items that reflected sense of

belonging as informed by interactions with and perceptions of others, which aligns to the revisions Tinto incorporated into his 2017 model that brought attention to the influence of students' perceptions, rather than institutional structures. Additionally, items that were focused on academic performance were found to be confusing or unrelated to sense of belonging. This was an unexpected response from the cognitive interviews, since academic motivation and instructional contexts were established to be influential on a students' course level experience as indicated by other researchers (e.g., Goodenow & Grady, 1993; Freeman et al., 2007). Slaten et al. (2018) make the case that these course-based factors might be too distal to influence students' sense of belonging. However, their instrument was contextualized to students' sense of belonging to the university, whereas the BCBS was developed for the course delivery context.

Ultimately, the new instrument developed with eleven (11) items was informed by experiences collected from both online and face-to-face students and vetted through expert opinions and interpretations by members of the target audience. The development of this instrument adapted practices from contemporary studies that have measured sense of belonging, aiming to achieve a similar brief, yet robust, instrument to measure postsecondary students' sense of belonging. This robust qualitative approach and iterative item writing process provided an intentional, and thoughtful approach to the development of an instrument, incorporating feedback from experts and centering students' experiences and voices.

5.6   Phases 2 and 3: Psychometric Investigations of the Brief Course Belonging Scale

5.6.1   Data Collection

Phases 2 and 3 entailed collecting quantitative data during the following semester immediately after Phase 1. These phases addressed RQs 2 and 3, which involved a psychometric investigation of the BCBS—the proposed instrument developed using the data collected in Phase 1. Based on the sampling design, 127 online and 123 face-to-face courses were included in this sample. The resulting sample was asked to participate in a questionnaire about their experiences on campus for internal reporting to SAL and TLAI. The BCBS was included in this questionnaire, along with measures of academic motivation, loneliness, connectedness, and sense of belonging to the university. During the last three weeks of this semester, partners in IR invited a sample of randomly selected students ($N = 2{,}643$) from randomly selected courses ($N = 250$) that met the inclusion criteria to participate in this university-wide questionnaire. Participants in the sample ($n = 305$; response rate = 11.5%) who were interested and provided their explicit consent, as required by the protocol approved by the Institutional Review Board (IRB), were included in Phases 2 and 3. The participants came from 146 courses (response rate = 58.4%).

Data were collected from undergraduate, graduate, and professional students using an online platform managed by partners from IR. The questionnaire was configured for randomization at both the instrument and item level to address any potential issues associated with participant fatigue or local item dependency. Additionally, a three-form design (Pokropek, 2011) was used to reduce cognitive load on the participants. In this design, three forms of the survey (see Appendix Table B7) were developed so that all

participants responded to the instruments measuring the primary constructs of interest (i.e., postsecondary students' sense of belonging to others within a course; academic motivation). Participants were then randomly assigned one of the instruments measuring the related constructs (i.e., university belonging, connectedness, loneliness), as well as one of the subscales of the UBQ (Slaten et al., 2018). The instruments to measure postsecondary students' sense of belonging to others within a course and academic motivation were paired together as a block within the questionnaire and presented first to mitigate any possible measurement error due to the priming of other constructs. The data from participants who expressed consent to participate in the study was anonymized prior to any analyses, as directed by the honest broker agreement established through the approved study protocol.

5.6.2   Measures

To conduct a psychometric investigation of postsecondary students' sense of belonging to other students within online and face-to-face courses, an online questionnaire was administered that included the BCBS and the following instruments to measure related constructs to answer RQ2 and RQ3.

5.6.2.1   Brief Course Belonging Scale

The Brief Course Belonging Scale (BCBS) is a new instrument developed as part of Phase 1 of this study. Reliability and validity evidence for the BCBS was developed based on using existing guidelines (DeVellis, 2012; Kline, 2018) and standards for educational and psychological testing (AERA, APA, & NCME, 2014). Items reflect a critical review of existing belonging instruments (Goodenow, 1993b; Whiting et al., 2018), qualitative data collected from Phase 1 of this study. Specifically, the items on the

BCBS were sourced from the thematic analysis of Phase 1 and revised based on feedback form expert reviews and cognitive interviewing. The final iteration of the BCBS ($\alpha = .96$) is a result of iterative item writing (Saldaña, 2016), refined through cognitive interviews (Peterson et al., 2017) and expert reviews (Worthington & Whitaker, 2006). The final 11 items (Appendix Table B8) is rated on a 4-point Likert-type response format ranging from 1 (*strongly disagree*) to 4 (*strongly agree*), which was chosen following existing students' sense of belonging scales (Slaten et al., 2018; Whiting et al., 2018).

5.6.2.2 University Belonging Questionnaire

The University Belonging Questionnaire (UBQ; Slaten et al., 2018) was developed as an instrument designed specifically for use with postsecondary students, rather than adapted to fit the higher education context. The final 24 items (Appendix Table B9) were developed based on semi-structured interviews with undergraduate students (Slaten et al., 2014) and grouped into three subscales—university affiliation, support, and relationships. Items on the UBQ are rated on a 4-point Likert-type response format ranging from 1 (*strongly disagree*) to 4 (*strongly agree*) with reliability estimates for each subscale ranging from $\alpha = .91$ to $\alpha = .93$ for this sample. Higher scores in the UBQ indicated a greater sense of belonging to the university.

5.6.2.3 Expectancy-Value-Cost Scale

The Expectancy-Value-Cost Scale (EVC; Kosovich et al., 2015) has been administered with postsecondary students and measures "three theoretically separate and important motivational constructs" (p. 792). The EVC is a 10-item instrument (Appendix Table B10) assessing student academic motivation and uses a 6-point Likert-type

response format ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). Sample reliability ranged from α = .78 to α = .93 in this study.

5.6.2.4   Social Connectedness Scale

The Social Connectedness Scale (SCS; Lee & Robbins, 1995) has been administered with postsecondary students. The SCS is an 8-item instrument (Appendix Table B11) that was designed to measure emotional distance from others. The instrument uses a 6-point Likert-type response format ranging from 1 (*strongly agree*) to 6 (*strongly disagree*). Sample reliability was α = .94 in this study.

5.6.2.5   UCLA Loneliness Scale

The UCLA Loneliness Scale (UCLALS; Russell et al., 1980) has been administered with postsecondary students. The UCLALS is a 20-item instrument (Appendix Table B12) assessing global loneliness. Higher scores on the UCLALS indicate more loneliness. The instrument uses a 4-point Likert-type response format ranging from 1 (*never*) to 4 (*always*). Sample reliability was α = .91 in this study.

5.6.3   Analyses

Prior to conducting the quantitative analyses, I evaluated the polytomous and multilevel structure of the data following procedures outlined by Reise et al. (1993) and Toland (2014). The response categories were collapsed from four responses (Strongly disagree, Disagree, Agree, Strongly agree) to two (i.e., Strongly disagree and Disagree to Disagree [0]; Strongly agree to Agree to Agree [1]) by pairing adjacent response categories (see Appendix Table B13). After employing this acceptable practice to truncate choices to mitigate model convergence issues, I was able to treat the data as

dichotomous and obtain maximum information on the data collected (Rutkowski et al., 2019). After collapsing adjacent response choices, the higher number (1) indicated greater sense of belonging.

5.6.3.1 Confirmatory Factor Analysis

Considering the nested structure of the data collected from the BCBS, a within-cluster construct with a saturated level-2 (see Figure 5.2) was anticipated. Stapleton (2016) explained that, as a justification for conducting a within-cluster construct model, this approach allows for cluster-level variability with a saturated model of the covariances among the clusters because this model does not assume existence of a cluster-level construct. According to Stapleton, this is important because "The within-cluster covariation is used to test the plausibility of a within-cluster construct that may be used in the future to compare individuals who share a cluster or to identify relations among constructs within a cluster." (p. 491).

Figure 5.2

Within-cluster Construct Multilevel Model for the Brief Course Belonging Scale

$$\eta_{1B} \quad \cdots \quad \eta_{11B}$$

$$\text{BCBS}_1 \quad \cdots \quad \text{BCBS}_{11}$$

$$\eta_{1W} \quad \cdots \quad \eta_{11W}$$

$$\lambda_{W11} \qquad \lambda_{W111}$$

$$\xi_{W1}$$

$$\varphi_{W11}$$
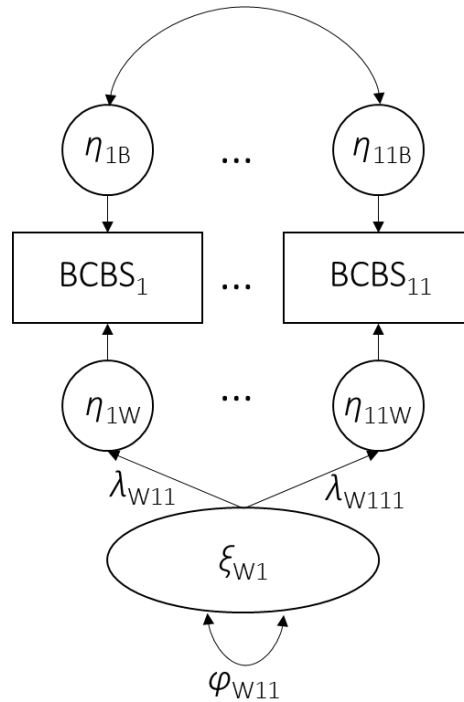
Note. Within-cluster construct model based on multilevel confirmatory factor analysis procedure proposed by Stapleton (2016). Each within component also has a residual with a variance θ, not show for simplicity. B = between-cluster level; W = within-cluster level; n = number of item; η = mean; φ = factor variance; λ = loadings relating items to ξ; ξ = students' sense of belonging to other students within the course; BCBS_n = observed response to BCBS item.

Although conceptually, this model is a realistic approximation of the construct of

postsecondary students' sense of belonging to others within a course as experienced in

reality, issues of model convergence occurred when a multilevel approach was used.

Instead, to answer RQ2 and RQ3 using the data collected, a single-level confirmatory

factor analysis (CFA) was conducted rather than an MCFA.

CFAs were modeled separately for the online sample and the face-to-face sample.

Conducting the CFAs for both contexts provided evidence regarding the stability of the

one factor structure in the data, regardless of course delivery context. The CFA was

estimated with the weighted least squares with mean and variance correction (WLSMV) procedure because of the ordered categorical nature of the item responses on the BCBS and there were no missing item-level responses on the BCBS. The WLSMV estimator produces exact and approximate fit indices, which allows us to assess the model fit using guidelines provided by Asparouhov and Muthén (2018). Exact fit was concluded if the χ^2 was not significant ($p > .05$). Otherwise, approximate fit was concluded if standardized root mean square residual (SRMR) was $\leq .08$ and no large absolute residual correlations was observed. According to Kline (2016), small absolute residual correlations can be defined as those less than or equal to .10. Additionally, the comparative fit index (CFI), Tucker-Lewis Index (TLI) and root mean square error of approximation (RMSEA), where CFI/TLI $\geq .95$ and RMSEA $\leq .05$ was also considered (Hu & Bentler, 1999).

5.6.3.2   Multilevel Hierarchical Ordinal Logistic Regression

Following the CFA, a series of multilevel item-level analyses were conducted to provide further evidence of the internal structure of data on the BCBS so that arguments could be made around the comparability of the BCBS based on course delivery context. Since the intended structure of the data collected was multilevel, I attempted an item-level analysis that reflected the nested structure of the data. The data allowed for the utilization of hierarchical ordinal logistic regression (HOLR), a robust procedure that accounted for both the polytomous item response options used to collect data on the BCBS and the nested nature of the measuring postsecondary students' sense of belonging to other students within the same course.

The HOLR procedure allows for likelihood ratio testing (LRT) using the log likelihood (LL) and -2 log-likelihood (-2LL) of three models that are compared to

determine significance and simultaneous assessment of uniform and nonuniform DIF. This application of ordinal logistic regression across nested within three hierarchal models has been utilized for a wide range of education and health-care studies (e.g., Claseman, 2012; Crane et al., 2016; Sharafi et al., 2017) due to the nested nature of student and patient level data, similar to the structure of the data collected on the BCBS. For this study, each item on the BCBS was assessed for DIF using this HOLR. These analyses were conducted in Mplus 8.4 (Muthén & Muthén, 2019).

In this procedure, I tested the data collected on the BCBS for nonuniform DIF by conducting a LRT that compares the full model to a reduced model. The full model includes the total score on the BCBS, the group score on the BCBS, and an interaction variable of the total and group scores as predictor variables in the HOLR. The reduced model does not include the interaction. If the LRT in this comparison be significant, then nonuniform DIF was flagged. If the initial LRT was not significant, then a follow up comparison between the reduced model and a second reduced model without the group scores (i.e., only the total score), was conducted. Should the LRT for this second comparison be significant, then uniform DIF was flagged. If the LRT was not significant, then I was able to conclude that the DIF was not detected for the particular item being inspected. The results of the DIF assessment were used to determine the removal of any items for the 11-item BCBS to produce a final scale.

5.6.3.3 Correlational Evidence

Within the structural equation model (SEM) framework, correlational evidence of validity for the scores derived from the new BCBS was assessed with data collected on postsecondary students' reported sense of belonging to the university, academic

motivation, loneliness, and social connectedness. Bandalos (2018) states that "Constructs are often hypothesized to share certain characteristics with other constructs…evidence of such convergence is relevant" (p. 289). Correlations between sense of belonging to the university, academic motivation, loneliness, and social connectedness were used to investigate convergent validity evidence for the BCBS. Correlations between these constructs that exhibit high magnitude, despite the direction (i.e., positive or negative correlations), provide evidence for convergent validity. Following this guideline, the BCBS and its' correlation with the other instruments was investigated using Mplus 8.4 (Muthén & Muthén, 2020).

5.6.4 Results

5.6.4.1 Confirmatory Factor Analysis

Prior to the CFA, I computed the intraclass correlations (ICCs) for both samples. The ICCs and corresponding design effect (DEFF) values are in Table 5.3 which show the ICCs ranged from .000 to .165 for the online sample and .000 to .274 for the face-to-face sample, which indicate little variability is occurring at the course level. Ignoring this would violate the independence assumption and result in model convergence issues. However, the DEFF values suggest that the clustering issue was less of a concern than originally realized given the values are 1. A value of 1 indicates that there is no clustering effect and that the standard errors that assume random sampling will not produce biased results. Results from this preliminary inspection suggested that the multilevel model of the structure was problematic because of the low ICCs. Specifically, the multilevel models would not converge. However, it was possible to continue with a single level

CFA since none of the DEFF were greater than the recommended threshold value of 2

(Muthén & Muthén, 2011).

Table 5.3

Summary of Item-Level Interclass Correlation Coefficients for the Brief Course Belonging Scale

Item		ICC (DEFF)	
		Online	Face-to-Face
BCBS1	I feel like my contributions during class activities matter to other students in this course.	0.000 (1.000)	0.102 (1.085)
BCBS2	I feel appreciated by other students in this course.	0.045 (1.037)	0.000 (1.000)
BCBS3	I want to keep in touch with other students after this course is over.	0.165 (1.137)	0.118 (1.098)
BCBS4	I feel like other students in this course encourage me to do well.	0.000 (1.000)	0.000 (1.000)
BCBS5	I feel respected by other students in this course.	0.000 (1.000)	0.000 (1.000)
BCBS6	I feel like other students in this course accept me for who I really am.	0.000 (1.000)	0.001 (1.001)
BCBS7	I can be myself with other students in this course.	0.000 (1.000)	0.000 (1.000)
BCBS8	I feel like other students in this course understand my ideas when I share what I am thinking.	0.000 (1.000)	0.000 (1.000)
BCBS9	I feel supported by other students in this course.	0.000 (1.000)	0.000 (1.000)
BCBS10	If I face academic challenges in this course, I feel comfortable asking other students for help.	0.000 (1.000)	0.274 (1.000)
BCBS11	I feel included by other students in this course.	0.000 (1.000)	0.043 (1.098)

Note. ICC = Interclass correlation coefficient; DEFF = Design effect.

To partially answer RQ2 and RQ3, the CFA was modeled using WLSMV

estimation. Based on guidelines provided by Asparouhov and Muthén (2018), global fit

of the CFA model was assessed using χ^2 and SRMR testing. Exact fit was established

based on non-significant results, in which χ^2 (55, $N = 132$) = 56.914, $p = .440$ for the

online sample and χ^2 (55, $N = 173$) = 55.238, $p = .466$ for the face-to-face sample. The

results of the global fit indices for the CFA are summarized in Table 5.4.

In addition to the global fit results, local fit was assessed using residual correlations. Absolute residual correlations above 0.2 were flagged as potentially problematic (Morizot et al., 2007). For the online sample, residual correlations ranged from .00 to .28. The face-to-face sample residual correlations ranging from .01 to .30. The residuals for both samples were acceptable since less than 1% of the correlations were flagged and the pairs of items that exceeded this cutoff tended to have no theoretical reason for correlating (e.g., BCBS 7 and BCBS 9), which further reinforced the model fit conclusion.

Table 5.4

Summary of Fit Indices for the Confirmatory Factor Analysis of the Brief Course Belonging Scale

Context	N	$\chi^2(55)$	p	SRMR	CFI	TLI	RMSEA
Online	132	56.914	.4404	.062	1.000	1.000	.016
Face-to-Face	173	55.238	.4656	.081	1.000	1.000	.005

Note. SRMR = Standardized Root Mean Square Residual; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSE = Root Mean Square Error of Approximation.

5.6.4.2   Multilevel Hierarchical Ordinal Logistic Regression

The results of the multilevel HOLR analyses are summarized in Table 5.5. The LRT conducted on each item across the full model (total + group + total*group), first reduced (total + group), and second reduced (total only) models were compared. The simultaneous assessment suggested that nonuniform DIF was detected for BCBS 2, 8 and 10. For BCBS 2, 8, and 10, the assessment between the LRT of the full model and first reduced model was significant, which suggested nonuniform DIF was present. A further comparison of these three items for uniform DIF was not necessary. Uniform DIF testing

was conducted and observed on all the remaining items based on a significant LRT when the first reduced model and the second reduced model were compared.

Since the ICCs for this data was found to be low (Table 5.3), HOLR analysis was repeated, ignoring the nested data structure. The same inferences were established when treating the data as single level, maintaining the original results. Furthermore, the magnitude of the differences in slopes (for items exhibiting nonuniform DIF) and intercepts (for items exhibiting uniform DIF) across course delivery contexts were investigated to fully understand the data collected from the BCBS. Following guidance from de Ayala (p. 342, 2009), the range of the magnitude of the nonuniform DIF was narrow ($\tau_3 = 0.02$ [BCBS 10] to 0.25 [BCBS 8]), and the magnitude of the uniform DIF was wider ($\tau_2 = -0.19$ [BCBS 7] to 1.98 [BCBS 4]). The magnitude could be considered small to moderate, with only the uniform DIF on BCBS 4 exhibiting a large magnitude between the two course delivery contexts. Overall, these results limit the ability to compare responses between the online and face-to-face samples. The results may provide insights into RQ2, but these findings limit our ability to answer RQ3 with confidence given the presence of DIF.

Table 5.5

Multilevel Hierarchical Ordinal Logistic Regression Model Comparisons Testing For Differential Item Function (DIF)

Item	Full Model	Reduced Model 1	Nonuniform DIF test (*p* value)	Reduced Model 2	Uniform DIF test (*p* value)
Nonuniform DIF					
BCBS2	2194.79	2194.28	-0.51 (< .001)	--	--
BCBS8	2307.36	2314.16	6.80 (< .001)	--	--
BCBS10	2204.97	2186.24	-18.73 (< .001)	--	--
Uniform DIF					
BCBS1	2239.30	2241.57	2.27 (.132)	2681.10	434.95 (< .001)
BCBS3	2195.15	2195.26	0.11 (.740)	2650.10	454.84 (< .001)
BCBS4	2177.81	2179.07	1.25 (.263)	2616.27	437.20 (< .001)
BCBS5	2313.15	2313.15	0.08 (.929)	2739.26	426.11 (< .001)
BCBS6	2249.01	2249.46	0.45 (.503)	2687.36	437.90 (< .001)
BCBS7	2257.35	2257.55	0.19 (.659)	2695.02	437.47 (< .001)
BCBS9	2135.67	2135.76	0.09 (.769)	2535.88	400.12 (< .001)
BCBS11	2189.72	2189.90	0.17 (.677)	2627.23	437.33 (< .001)

Note. Full model = predictors included total score, group membership variable, and interaction between total and group membership variable. Reduced model 1 = predictors included total score and group membership variable. Reduced model 2 = predictor included total score only. Uniform DIF test = -2LL(Reduced Model 2) – 2LL(Reduced Model 1) and associated *p* value in ( ). Nonuniform DIF test = -2LL(Reduced Model 1) – 2LL(Full Model) and associated *p* value in ( ). The LRT test for nonuniform and uniform DIF were both 1 *df* tests.

5.6.4.3   Correlational Evidence

Postsecondary students' sense of belonging to other students within the same course was expected to (a) have the strongest correlation with sense of belonging at the university level (positive) and connectedness (negative); (b) exhibit a medium to strong positive correlation with academic motivation; and (c) exhibit the weakest (negative) correlation with loneliness. These associations (or correlations) were inspected separately for the two samples because of the lack of measurement invariance and summarized in Table 5.6. For the online context, postsecondary students' sense of belonging to other students within the same course was found to have the highest positive correlation with

sense of belonging to the university among the related constructs, as expected, despite

only a moderate magnitude ($r = .61$). The construct exhibited moderate positive

correlations with academic motivation and social connectedness ($r = .54$; .36,

respectively), and a negative, low magnitude relationship with loneliness ($r = -.37$). For

the face-to-face context, sense of belonging to other students within the same course

exhibited a positive, but lower magnitude with sense of belonging to the university and

academic motivation among the face-to-face sample ($r = .33$; .31, respectively). With the

face-to-face sample, social connectedness exhibited a moderate positive relationship with

($r = .46$) postsecondary students' sense of belonging to others within the same course,

and whereas the relationship with loneliness was moderate and negative ($r = -.45$).

Table 5.6

Observed Correlations of Postsecondary Students' Sense of Belonging to Others Within the Course and Scores on Related Measures

Measure	1	2	3	4	5
1. Course-level Belonging[a]	.99 (.97)	.61*	.54*	.36*	-.37*
2. University-level Belonging[b]	.33*	.98 (.98)	.60*	.19	-.25*
3. Academic Motivation[c]	.31*	.11	.92 (.94)	.41*	-.31*
4. Social Connectedness[d]	.46*	.59*	.25*	.97 (.94)	-.81*
5. Loneliness[e]	-.45*	-.53*	-.18	-.79*	.96 (.94)

Note. Online ($n = 173$) correlations are above the diagonal. Face-to-Face ($n = 132$) correlations are below the diagonal. Omega reliability values for Online sample are on the diagonal; for Face-to-Face sample are inside the parentheses on the diagonal. Constructs were measured by: [a]Brief Course Belonging Scale; [b]University Belonging Questionnaire (UBQ; Slaten et al., 2018); [c]Expectancy-Value-Cost Scale (EVC; Kosovich et al., 2015); [d]Social Connectedness Scale (SCS; Lee & Robbins, 1995); [e]UCLA Loneliness Scale (UCLALS; Russell et al., 1980).
*$p < .05$.

5.6.5   Discussion

Following the instrument development work of Whiting et al. (2018) and Slaten et

al. (2018), I conducted a psychometric investigation of the internal structure of a new

proposed instrument, the Brief Course Belonging Scale (BCBS), and collected correlational evidence to establish validity of the scores from this new instrument across two course delivery contexts—online and face-to-face. This investigation was comprised of CFA and detection for DIF, followed by correlational analysis of the scores on instruments measuring related constructs (i.e., sense of belonging to the university, academic motivation, social connectedness, and loneliness). Specifically, I was seeking to answer whether items on BCBS differ between online and face-to-face students and if there was a difference in students' sense of belonging based on these contexts. These psychometric investigations prioritize DIF analysis before comparative analyses are conducted, as recommended by Martinková et al. (2017).

The CFA results supported the unidimensional treatment of the data collected on the BCBS for both samples. This evidence is aligned with the findings by Whiting et al. (2018) on the Simple School Belonging Scale (SSBS), which was an instrument developed in response to multidimensionality issues demonstrated by the Goodenow's (1993b) Psychological Sense of School Membership Scale. Similarly, the BCBS used in this study was a response to the University Belonging Questions (UBQ; Slaten et al., 2018). Whereas the UBQ included items regarding affiliation to the university or reflective of the many relational groups across campus, the BCBS focused solely on sense of belonging to other students within a specific course, which may be the reason for an affirmative confirmatory factor analysis. Additionally, the BCBS extends from the work on the UBQ in that the CFA is conducted separately for the two course delivery contexts, providing insights to data collected for the online and face-to-face samples.

Finding exact fit for both of these course delivery contexts supports that the BCBS can be treated as a unidimensional instrument, regardless of course delivery context.

Despite CFA results demonstrating that the BCBS was unidimensional within a given course delivery context, DIF investigation detected differences in responses to BCBS items across fully online and fully face-to-face student groups. Andrich and Hagquist (2015) highlighted that "An item is defined to have no DIF between groups if, for the same value on the variable defined by the instrument, persons from the different groups have the same expected value for their responses to the item" (p. 187). DIF testing provides evidence that differences in response patterns are detected between the two course delivery contexts, and for majority of the items, these differences are uniform, signaling a difference in intercepts (Bauer, 2016). The other three items (BCBS 2, 8, and 10) not only differ at the intercept, but through the detection of nonuniform DIF, was detected to exhibit differences on the slopes across the two course delivery contexts. These DIF results complement findings by other researchers (e.g., Angelino et al., 2007; Francis et al., 2019) that have observed unique differences to the online course delivery context.

Although the intention of the BCBS was to attempt the measurement of postsecondary students' sense of belonging across contexts using a common instrument, uniform differences in responses to almost all of the items is aligned with the existing literature about online course delivery contexts as unique experiences from traditional, face-to-face course delivery contexts (e.g., Hewson, 2018; Thomas et al., 2014). This is not too unexpected, given the qualitative findings from Phase 1 based on the description of sense of belonging for online and face-to-face students in the focus groups. Item level

differences limit the comparisons on the data collected from the BCBS between the online and face-to-face samples.

In addition to understanding the internal structure of the BCBS to gather insights on postsecondary students' sense of belonging to other students within the same course across online and face-to-face course delivery contexts, I collected data from related constructs for use as correlational validity evidence for the proposed instruments score usage and meaning. The constructs—sense of belonging at the university level, academic motivation, social connectedness, and loneliness—were specifically chosen for their empirically-evidenced relationships to students' sense of belonging. For both course delivery contexts, the inferences about the correlations were similar. The strength and direction of the relationships of the scores collected using instruments that measure each related constructs to the scores on the BCBS were similar, however slight differences in the value of the magnitude are worth noting.

The EVC (Kosovic et al., 2015) specifically asked students about their expected value of the course, as an indicator of their academic motivation. Data collected using the EVC suggested that the academic motivation of the online sample exhibited a strong, positive relationship with their sense of belonging to other students within the same course. The data collected from the face-to-face sample resulted in a slightly weaker relationship. Across contexts, these correlational findings within the samples suggest that sense of belonging at the course level has value.

Data collected on social connectedness (SCS; Lee & Robbins, 1995) and loneliness (UCLALS; Russell et al., 1980) demonstrated that for both fully online and fully face-to-face students, social connectedness increased, whereas loneliness decreased,

as sense of belonging to other students within the same course increased. As sources of evidence for validity, these findings are similar to findings from existing studies (e.g., Whiting et al, 2018; Slaten et al., 2018) which showed similar relationships to data collected on instruments measuring these two constructs. Across both course delivery contexts, although the magnitude of the results were weaker than expected, the relationships of the data collected on these constructs with the data collected on postsecondary students' sense of belonging to other students within the same course provided the hypothesized associations to confirm the validity of the scores on the BCBS for both online and face-to-face samples separately.

5.7   Conclusion

This study utilized a mixed method approach to address a series of research questions designed to extend the body of scientific knowledge on students' sense of belonging. Specifically, this study pursued a line of inquiry on postsecondary students' sense of belonging to other students within the same course building on limited, although seminal, research regarding the measurement of this complex and elusive construct. Goodenow and Grady (1993) situated their research on students' sense of belonging at the classroom level, but focused on students in the middle grades (6th through 8th grades). Slaten et al. (2018) conducted research on postsecondary students' sense of belonging, but at the university or institution level, not at the course level. Additionally, Slaten's instrument is extensive, consisting of 24 items that make up three subscales. There are currently no brief instruments for use with postsecondary students, despite researchers (i.e., Whiting et al., 2018) demonstrating that simple scales with fewer items can be psychometrically robust and capable of measuring students' sense of belonging.

The proposed instrument in this study—the Brief Course Belonging Scale (BCBS)—attempts to address these concerns by (a) defining postsecondary students' sense of belonging to other students; (b) proposing an instrument to measure postsecondary students' sense of belonging to other students within the same course; and (c) investigating the psychometric qualities of the proposed instrument. In response to the rapidly changing higher education landscape that is venturing into online education, this line of research was pursued across two distinct course delivery contexts—online and face-to-face.

The BCBS pushes the conversations about the construct of sense of belonging to new avenues: the postsecondary student perspective and the context of online courses. Although there have been decades of work that addresses sense of belonging in a variety of contexts, this study uniquely addresses a timely and relevant issue that has been exacerbated by current events: online learning as the future of higher education. Additionally, the psychometric issues that occurred as part of this instrument development study—particularly related to the collapsed response categories and the DIF identified on all items—set a path for even further conversations about the measurement of this elusive construct within the evolving context of online learning. Students' sense of belonging has been empirically and conceptually linked to student success (e.g., Goodenow & Grady, 1993; Tinto, 2017; Walton & Brady, 2017), and some even to the online learning experience (e.g., O'Shea et al., 2015), but much more to learn about how the resources, interaction, and relationships that contribute to students' sense of belonging could be measured and, for the sake of student achievement, be improved.

5.7.1   Limitations

This study was designed in close collaboration with content and field experts. Feedback from the target audience was solicited and the final iteration of the BCBS was developed to as near ideal situation as recommended by instrument development experts (e.g., Creswell & Plano Clark, 2018; DeVellis, 2012). Despite the careful intention, this study was conducted with certain limitations. First, issues with the sample prevents the generalizability of the findings from the new instrument. The results are sample dependent, limited in both size and diversity, reducing the statistical power to conduct the multilevel analyses that was intended. Additionally, for both the qualitative and quantitative data collection, the sample was a convenient sample and may not have captured the variety of experiences that occur. Specifically, during the focus group recruitment process, I was unable to recruit male participants who identified as Black or Latino. Another limitation was the decision to collapse the data collected from four response categories to two response categories. Although this is an acceptable practice (e.g., Rutkowski et al., 2019; Toland & Usher, 2016), important information was lost and statistical analyses were constrained; thus, making findings sample dependent and replication necessary. A final limitation to this study was that the data collection coincided with the host university decisions to move to completely remote instruction in response to a global pandemic. Although students were on Spring Break at the point of data collection and had not adjusted to the change in course delivery context, it is uncertain whether there was an influence on how students—specifically, face-to-face students—responded to the BCBS. Thus, the self-reports from students about how their sense of belonging to others in their course was perceived before the university response

to move all instruction to an online context was likely tainted by the global pandemic. However, this sociocultural event is known to effect all respondents the same way.

5.7.2   Future Research

Due to the limitations during the data collection process, future research should primarily focus on the expansion of the BCBS to a larger sample to allow adequate testing for DIF. The psychometric investigations for this new instrument were limited and there are several questions that require further consideration. With the BCBS as a unique instrument that measures postsecondary students' sense of belonging at a course level, the same inclusion criteria can be followed as the one used in this study, but with the expansion of the cluster sizes to allow for the multilevel analyses that was originally intended. The specific context of the course level should be investigated since ongoing work on sense of belonging at the university or institution level is being actively pursued (e.g., Slaten et al., 2018; Tinto, 2017). Additionally, the sample should be expanded to understand the experience of diverse student populations (e.g., Hurtado & Carter, 1997; Strayhorn, 2012; Vaccaro et al., 2015) at both the qualitative and quantitative phases of this study. As online courses and programs expand to include more undergraduate students, the BCBS should be collected from both graduate and undergraduate students, since this sample was majority graduate students due to the established inclusion criteria. Perhaps additional focus groups or cognitive interviewing opportunities should be offered to further refine the BCBS, prior to expanded data collection. Research conducted by Lewis et al. (2019) on sense of belonging and microaggressions experienced at a historically White institution demonstrates the profound need for further research of this

construct, should practitioners and researchers alike truly hope to improve retention and graduation for marginalized students.

A psychometric measurement research agenda should include the investigation of the response categories offered to postsecondary students when measuring sense of belonging. Similar to the work by Toland and Usher (2016), the developmental level of postsecondary students, the construct as situated in the course level and context, and the cognitive demand of the item phrasing may all contribute to the number of response options available to gather information on postsecondary students' sense of belonging to other students within their courses.

Last, after a post-pandemic world where the online course delivery context deliver became the norm, the data should be collected during a time when instruction is delivered without interruption. With the rapid push into online learning, the current study can serve as more of a pilot to inform a wider data collection process for future semesters. Once the BCBS is purified as a brief instrument to measure of postsecondary students' sense of belonging to other students within the same course, scores from the BCBS can be analyzed along with student success metrics, as well as other student beliefs (i.e., self-efficacy and perceptions about the curriculum) to test the model recommended by Tinto (2017). A further extension would be to use the scores to make comparisons across course delivery contexts and student demographics. This would fully actualize the potential of an instrument like this to help inform policies and practices that are influenced by this students' sense of belonging. However, before Tinto's model of student persistence can be tested in both online and face-to-face contexts, psychometrically sound instruments need to be developed for the different types of

course delivery contexts as well as diverse student populations. Domain-specific measurement of social cognitive constructs (i.e., "self" measures; Bandura, 2006) have been recommended over general measurement (e.g., general self-efficacy versus self-efficacy in math) by Bandura (2006). He states that "construction of sound efficacy instruments relies on a good conceptual analysis of the relevant domain of functioning…instruments must be linked to factors that, in fact, determine quality of functioning in the domain of interest" (p. 310). From this study, our findings support the domain-specificity of the course delivery context—online or face-to-face—as an important consideration to ensure reliable measurement that can provide validity evidence for appropriate interpretations.

Strayhorn (2012) provided insight into the persistence of sense of belonging as a construct that cannot be ignored when inquiring about the postsecondary student experience. He stated, "Deprivation of belonging in college prevents achievement and well-being. On the other hand, satisfaction of college students' sense of belonging is key to educational success" (p. 11). Because of the novelty of online learning contexts, the development of a more extended instrument should be seriously considered. Whiting et al. (2018) developed the SSBS in response to decades work of empirical and validation studies on Goodenow's (1993b) PSSM scale. Whiting's scale incorporated several items into the PSSM while maintaining brevity and without suffering reliability. As researchers and practitioners understand online learning more fully, perhaps a more thorough instrument should be developed to avoid construct underrepresentation within this novel context.

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CHAPTER 6. DISCUSSION

This dissertation research furthers the existing literature on students' sense of belonging by extending the body of knowledge into the postsecondary academic level and online course delivery context. Although decades of research has been conducted on students' sense of belonging, beginning with Goodenow and Grady (1993) to Whiting et al. (2018), the studies conducted as part of this dissertation join a limited body of empirical literature that investigates how sense of belonging is experience by students in higher education (e.g., Slaten et al., 2018) and in online learning environment (e.g., Hewson, 2018). Furthermore, this dissertation research presented two unique instruments. One was developed using existing items (i.e., SUBS adapted from SSBS) and the other by following a mixed method approach used to develop existing instruments based on a qualitative phase (i.e., BCBS followed the method used to develop UBQ). These instruments were designed specifically to measure students' sense of belonging among postsecondary students and field tested by using corresponding psychometric analyses conducted with modern measurement techniques. Recognizing the diversity in the student demographic and the course delivery context of the contemporary higher education experience, recommendations from researchers to conduct measurement invariance, or DIF, testing (e.g., Martinková et al., 2017) as part of the instrument development process was prioritized for both studies.

The SUBS and BCBS were both brief, unidimensional measures that were developed following guidelines for fair and equitable instrument development (AERA, APA, & NCME, 2014). Both were designed for use with postsecondary students, and with the intention that both instruments would not exhibit DIF. The results from the data

collected through the two studies suggested that both items were responded to differently by the student groups of interest. For the SUBS, it was evidenced that students who lived on campus and participated in residential programming responded to the items differently than their counterparts. For the BCBS, the data collected suggested that there were differences between students who were fully online responded to items in comparison to the students who were fully face-to-face. The differences in response patterns detected on both the SUBS and the BCBS limit our ability to use these scores collected from these instruments to compare experiences of sense of belonging. Since items are not stable across the different comparison groups, any comparison between groups would be flawed and could lead to inappropriate, and possibly invalid, interpretations of the results.

Although finding that the proposed instruments enjoyed measurement invariance was the more desirable outcome, the two overall findings that DIF was detected on a number of items on these brief scales, reinforces a valuable but often overlooked problem in instrument development. These findings bring attention to a problem of equity in educational and psychological measurement (Stark et al., 2006). Both the SUBS and the BCBS were developed following existing research, a common practice in this field. Previous instruments used to measure students' sense of belonging were inspected for global fit, specifically dimensionality, to ensure alignment with the conceptual basis of the construct, which was conducted as part of this dissertation. And while Whiting et al. (2018) conducted item level inspection, using item response theory-based techniques, and the Slaten et al. (2018) conducted measurement invariance testing across gender groups, this dissertation went beyond the global analyses and pursued evidence for item level measurement invariance. Whereas other empirical studies may have moved forward with

group comparisons of means and variances and interpretations of the results based on affirmative dimensionality testing that aligned with existing literature, this study inspected response patterns at the item level and established that DIF was detected. By conducting this additional level of inspection, the results revealed that the diverse experiences of sense of belonging found on campus can produce differences in response patterns. That is, an instrument may conceptually be constructed to meet what has been established in previous literature, but present psychometric issues based on the demographics of the sample and the context of the study.

Beyond the issue of measurement fairness, the interpretations and decisions made about students from different identities represented at the course and institution levels are susceptible to stigma-causing bias (Millsap, 2011) that not only affect their learning and instruction, but ultimately their retention and graduation (Tinto, 2017). The danger of this misunderstanding can penalize or marginalize students based on inaccurate or inappropriate interpretations due to faulty measurement. Understanding this risky potential error, the dissertation was designed with Martinková et al.'s (2017) recommendation in mind, that measurement invariance testing occur during instrument development and not just "check" at the end of data collection "to develop assessments that are more equitable measures of scientific knowledge" (p. 11). Despite the undesirable conclusion that further work needs to occur to purify both the SUBS and the BCBS, the findings from this dissertation support that DIF testing offers important methods to investigate equity during the instrument development process.

Additionally, both studies were subject to shared limitations. Issues with sample size and demographic representation (e.g., Study 1 had collapsed gender and ethnic

groupings, Study 2 had majority graduate degrees) limited the ability to conduct more robust analyses originally intended. Study 1 was sourced from a large sample size ($N = 4,851$), but the demographic representation within the sample did not represent the student population at the host university. For Study 2, the small sample size ($N = 305$) resulted in limited clusters, preventing multilevel treatment of the data. The response categories for both studies resulted in truncating or collapsing polytomous options into dichotomous options. However, this limitation regarding response options may require further investigation. For both studies to result in an adjustment to the categories that were used to originally collect the data may be caused by the brief and simple nature of both the SUBS and the BCBS. Additionally, perhaps the construct of students' sense of belonging may be most appropriately measured dichotomously at this developmental level. Perhaps Maslow's (1943) framing of this construct as a need, which has been supported by social psychologist (e.g., Walton & Brady, 2017), may be substantial theory to intentionally measure the presence or absence of the construct of sense of belonging, rather than along a categorical continuum. Last, although the student demographics and course delivery contexts were approached as general categories due to the classifications used by the university partners (e.g. underrepresented minority), future studies should consider expanding gender and ethnicity to include more specific identities (i.e., transgender women and men, minority ethnic groups) and nuances in instructional delivery (i.e., asynchronous/synchronous formats). This could be an opportunity to advocate for more inclusive data collection in educational research, if sample sizes for these specific categories can be obtained.

This dissertation was pursued, ultimately, not to study sense of belonging in isolation, but as a precursor to establish an instrument that can be used in empirical studies with student outcome dependent variables, such as persistence, retention, and graduation. Postsecondary students' sense of belonging has been conceptualized to have a predictive relationship with continued education, retention, and graduation (e.g., Han et al., 2017; York & Fernandez, 2018). But theories, like Tinto's 2017 model of student motivation and persistence has yet to be empirically investigated as a predictive model due to the lack of instruments available to measure postsecondary students' sense of belonging. Furthermore, the lack of a course level instrument or an instrument for use with students who are fully online limits that application of Tinto's model to these specific academic level and contexts. Once instruments like the SUBS and the BCBS are ready for generalized use, future research should include the addition of relevant dependent variables and group comparisons in a variety of contexts.

Appendix A

Table A1

*Sample Demographics for Study 1 (*N *= 4,851)*

Demographic	*n*	%
Residency		
On-campus	1,720	35.4
Off-campus	3,128	64.5
Unknown	3	0.1
Living-Learning Programs		
Participant	1,140	23.5
Non-participant	3,702	76.3
Unknown	9	0.2
Gender		
Male	3,158	65.1
Female	1,689	34.8
Unknown	4	0.1
Underrepresented Minority		
Yes	738	15.2
No	4,110	4.7
Unknown	3	0.1
Degree Type (*n* = 1,689)		
Undergraduate	887	52.2
Graduate	802	47.8

Note. Underrepresented minorities are students from American Indian/Alaskan Native, Black or African American. Hispanic or Latino, Native Hawaiian or Pacific Islander, and Multi-Racial (two or more races). Missing students (*n* = 3,162) were not included as part of the Degree Type count and analyses. Post-doctoral and Professional graduate students included in Graduate count.

Table A2

Simple University Belonging Scale

Item	Item phrasing	Response Choice			
SUBS1	Other students at UK take my opinions seriously.	NO!	no	yes	YES!
SUBS2	People at UK are friendly to me.	NO!	no	yes	YES!
SUBS3	I am included in lots of activities at UK.	NO!	no	yes	YES!
SUBS4	Other students at UK like me the way I am.	NO!	no	yes	YES!
SUBS5	I like to think of myself as similar to others at	NO!	no	yes	YES!
SUBS6	Professors in my classes care if I am absent.	NO!	no	yes	YES!
SUBS7	I feel like I matter to people at UK.	NO!	no	yes	YES!
SUBS8	People at UK really listen to me.	NO!	no	yes	YES!
SUBS9	I feel like my ideas count in my classes.	NO!	no	yes	YES!

Note. Instructions: For the following questions, reflect on your experiences at UK so far

Table A3

Proportion (in percentages) of Responses to the Simple University Belonging Scale by Items Response Category

Item	Dichotomous		Polytomous			
	Disagree	Agree	NO!	no	yes	YES!
SUBS1	9	91	1	8	61	30
SUBS2	4	96	1	3	61	35
SUBS3	26	74	5	21	46	28
SUBS4	7	93	1	6	61	32
SUBS5	18	82	4	14	56	26
SUBS6	18	82	3	15	52	30
SUBS7	13	87	2	11	57	30
SUBS8	15	85	3	12	56	30
SUBS9	14	86	2	12	59	27

Note. No! and no choices in the polytomous rating scale were collapsed to the No response choice in the dichotomous scale; YES! and yes choices in the polytomous rating scale were collapsed to Yes response choice in the dichotomous scale.

Appendix B

Table B1

*Sample Demographics for Study 2 (*N = 305*)*

Demographic	*n*	%
Course Delivery Context		
Online	173	56.7
Face-to-Face	132	43.3
Gender		
Male	89	29.2
Female	215	70.5
Not identified	1	0.3
Ethnic Group		
American Indian/Alaskan Native	0	0.0
Asian	14	4.6
Black or African American	21	6.9
Hispanic or Latino	15	4.9
Native Hawaiian or Pacific Islander	0	0.0
White or Caucasian	216	70.8
Multi-Racial (two or more races)	11	3.6
Decline to respond	2	0.7
Unknown	26	8.5
Degree Type		
Undergraduate	31	10.2
Graduate	219	71.8
Professional Graduate	55	18.0
Age (in years)		
Mean	31.92	
Median	28.00	
Mode	23	11.5
SD	10.51	
Range		
19-29	168	55.1
30-39	65	21.3
40-49	45	14.8
50-65	27	8.9

Table B2

Inclusion Criteria for Courses and Students

Excluded
  Study Abroad credit
  Postdoc credit
  Dissertation credit
  Master's thesis credit
  Internships and coops credits
  Compressed video section delivery modalities

Included section enrollments
  Active courses

Included students
  In a fully online degree program

Included sections
  Students per section greater than or equal to 5
  Match online program sections with traditional sections
    Class
    Class Leading Digit (e.g., 100 vs 200, etc.)
    Class Department
    Class College

Table B3

Focus Group Protocol Questions

Item	Question
FG Q1	In your experience, what does it mean to belong?
FG Q2	Specifically thinking about your own experience as a student, how would you describe your sense of belonging to the course?
FG Q3:	Describe a time when you felt you truly belong with others in your course?
FG Q4	What made you feel like you belonged with others during while you were in that course?
FG Q5:	If you were teaching a course, what would you do to make students feel like they belong?

Table B4

Field and Degree Levels of Expert Reviewers

Field	Masters-level	Doctoral-level
Education	2	1
Higher Education	1	1
Information Science	1	
Instructional Design	2	
Measurement		1
Psychology	2	4
Women & Gender Studies		1
Sociology		1

Table B5

Qualitative Analyses of Focus Group Description of Postsecondary Students' Sense of Belonging

Finalized Assigned Codes (N = 11)										
Feeling supported	Interest in others	Engaging actively	Sharing experiences	Feeling valued	Working on collective goals	Nurturing deep relationships	Finding commonalities (interest, goals)	Establishing affiliation	Needs reflected	Adjusting expectations
Thematic Analysis Based on Rater Coding (count and proportions in parentheses)										
Feeling secure enough to be open to connections (*n* = 41; 20.8%)	Being open to connecting with others (*n* = 22; 11.1%)	Having others to connect with in class (*n* = 22; 11.70%)	Understanding others by sharing personal experiences or interests (*n* = 22; 11.1%)	Feeling noticed by others (*n* = 18; 9.1%)	Performing to meet positive expectations (*n* = 18; 9.1%)	Connecting with instructors beyond typical evaluative relationship (*n* = 12; 6/1%)	Connecting with others based on commonality (*n* = 11; 5.6%)	Having a distal commonality (*n* = 11, 5.6%)	Finding a place that recognizes similar interests (*n* = 9, 4.5%)	[Open theme: created during conference with research team] (*n* = 11, 5.6%)
Initial Rater Codes Clustered By Themes (*N* = 197)										
Feeling comfortable with failure in front of others	Authentically investing in/engaging with the experiences of others	Establishing long term, constant communication	Creating authentic, unforced-connection by listening for shared experiences	Believing/being reassured that your voice and presence matter	Engaging with course content	Instructors authentically engaging me	Feeling co-ownership and responsibility of your relationships and what you're learning	Having a sense of community that establishes connectedness	Intentionally establishing a collaborative, ideal learning space	courses having smaller number of students facilitates open dialogues
Trusting others are reliable	Actively learning the identities of others	Growing new relationships with foundational (limited number of) relationships to fall back on	Forming authentic bonds with a limited number of people based on shared experiences	Celebrating and engaging with our differences	Opportunities for autonomous ownership of instruction	Being open to student feedback and incorporating it	asking students to join programs and organizations	Being able to engage with others to gain clarity about expectations and requirements	Sharing spaces (mental, physical, emotional, spiritual) with open-minded individuals	trying to create options for students who don't speak up as much to participate equally
Freedom to express your authentic self; sharing spaces (mental, physical, emotional, spiritual) with open-minded individuals	Being able to connect with different students each week	Assigning roles to a particular person	Having shared experiences (ideas, values, beliefs, traditions)	Flexibility for work-life balance	Opportunity for autonomous ownership	creating meaningful interactions and connections with instructor	Being a part of a group sharing the same goal	connecting by being in similar courses and fields of study	communicating through multiple mediums	working in groups

Table B5 (continued)

Knowing you're supported through your failures and successes	Being able to trust someone's authenticity	being familiar with classmates	Engaging our common experiences with others	feeling others reaching out and engaging with you	Accomplishing more by having others with you as opposed to being alone.	feeling that instructors care about you beyond the grade that you get	feeling like you are in a program that is your passion	courses having subject matter that engages	courses having smaller number of students facilitates open dialogues	Feeling like you're on a team
Creating a sense of light-hearted connectedness	Being accessible and present	connecting students with others who have similar interest areas to them in the class	Developing community through close-knit, authentic relationship	Feeling respected by others	Continuously trying to perfect your craft	getting individualized attention from professor	Working well with others to finish work	Discussing similar things with peers	engaging in multiple avenues to find ways to engage with others	getting individualized attention from professor
Feeling caring and understanding from others	connecting to other people during brief periods of time	encouraging interacting with other students in the class	Facing similar challenges to those around you	Fitting in with your group	Developing a desire to continue learning	getting to interact with the instructor	Finding ways to engage with campus life and activities	Feeling connected to the people and place of your program	Feeling connected is different in an online class	Growing new relationships with foundational (limited number of) relationships to fall back on
Feeling safe to share your opinion to other people	Discovering how to feel close to others	facilitating students to personally connect outside of course material through a separate forum	Getting to know what peers' interests were outside of the learning environment to connect	having a picture of yourself	engaging in deep discussions about field of study	getting to interact with the instructor	giving students welcome materials to the class	Feeling like you are part of the community	Feeling unthreatened by my enviornment	implementing a system for students to interrupt to ask questions safely
Feeling support from others	Experiencing peers as personable and easy to work with	Feeling comfortable with learning from others	giving students the option for more meeting times together	having options for students who do not enjoy group assignments	Engaging in discussions with all students present to promote engagement with each other	getting to know the professor personally	having course content combined with good peers and instructors	Feeling like you're on a team	having the chance to get up and go to social gatherings with others	connecting students with others who have similar interest areas to them in the class
having an easier time discussing difficult topics on discussion boards	Feeling capable of making meaningful connections with others	feeling connected to faculty, students, and the course material	having context about others' backgrounds and personalities	having students introduce themselves and share assignment results using webcamera	Feeling capable when there are clear guidelines to follow for course success	Having an actively engaged facilitator	having the sense you are supposed to be in the class and that you're with the right people	feeling supported as a team	Innate feeling of community	including assignments focused on having students getting to know each other personally and working as a team unit

Table B5 (continued)

Instructors proactively alleviating my need for defense mechanisms	feeling others are nice	Having consistently engaging dialogue with peers	Having others to share life experiences with that are common to the group	having the chance to see people's faces while they talk about course content to see emotions	getting to know others in class and then forming groups to accomplish class goals	having the option to talk to students offline	including group projects for students to complete	getting invited to campus events	Instuctors recognizing and catering to the different needs of individual learners	Forming authentic bonds with a limited number of people based on shared experiences
Knowing other people will support you	Having others to rely on outside of class	Having familiarity with the people around you	Having shared experiences within your group	Having the flexibility to engage all aspects of your developing development	Having clear expectations for what is needed to succeed	implementing a system for students to interrupt to ask questions safely	Instructors creating an enviornment fof shared experiences to surface	having personalized newsletters for online students	making accomodations for how much help other people need to accomplish a goal	having options for students who do not enjoy group assignments
Knowing that your learning institution supports your success	having the chance to do social networking	having the option to talk to both classmates and the professor	learning about peers personal lives through discussion boards	having the option to complete work at your own pace	Instructors engaging me holistically	Instructors demonstrating authentic investment in your ideas and growth	Involving oneself in campus events	having the support of family	Overcoming barriers to connect with others while learning online	
not singling out people in the class	Instructors immediateley scaffolding open-minded engagement	including assignments focused on having students getting to know each other personally and working as a team unit	Navigating differences to accomplish a common goal	holding office hours via webcam to increase accessibility for students	Knowing that what you're learning is relevant	Making time for me / ease of access to you	Learning a new program collectively with your group	including students in deartmental mass emails	Seeing that there is organization and simplicity	
relying on other people outside of class and/or geographic region	putting in effort to get to know others in online class	Instructors facilitate connecting to other students	wanting to know classmates outside of course content and assignments	Instructors reminding you that your presence matters	Learning more by engaging with other students and building on your ideas	Professors showing effort in class	Relying on other students as you navigate toward common goal	Sharing a common goal	subject matter being useful and engaging to you	
sensing a bond with someone else that makes you feel like you fit in	recognizing peers from previous classes	letting other students know who else is in the class with them	Wanting to support others and feel supported in return	Knowing that your opinion is valued by others	motivating yourself to participate with your group	providing students with feedback measures about leadership style	Sharing interests with other people around you	Understanding one's role in the larger course context	trying to create options for students who don't speak up as much to participate equally	

Table B5 (continued)

Trusting you can rely on others	Sensing the authenticity of people and the spaces/enviornments they create	seeing others' faces through use of webcamera	making sure all students participate in class	Talking to students outside of main discussion for to help support each other	sending positive emails to students regularly	Sharing similar passions and goals with others in groups	wanting to feel included throughout degree programs
	wanting to get to know people	Sharing a relationship with peers and faculty	possessing empathy for students who work fulltime and have family commitments	using engaging lecture materials	setting up web camera sessions with the professor to review content and ask questions	using group activities to increase group cohesion amongst students	Working together with others toward a shared goal
		sharing consistent classmates throughout degree program using messaging with the class to be organized	providing an option for Zoom meetings during the class		transcribing lectures for students		working in groups
		using web camera sessions to connect to other peers	providing flexibility to meet students and accommodate their personal lives		using web cameras to record lectures		
		using webcamera sessions to engage face to face Wanting to know who was speaking and contributing during class	Supporting the growth of my invisible identities		Wanting to get to know students well to create sense of closeness		
			Wanting validation for their efforts in class				

Table B6

Iterative Revisions to Proposed Items for the Brief Course Belonging Scale

Item	Original item	After expert review 1	After cognitive interview	After expert review 2	Final item
1	My contributions matter to other students in this course.	My contributions matter to other students in this course.	My contributions in class matter to other students in this course.	My contributions in class matter to other students in this course.	I feel like my contributions during class activities matter to other students in this course.
2	I feel that other students in this course appreciate me.	I feel that other students in this course appreciate me.	I feel that other students in this course appreciate me.	I feel that other students in this course appreciate me.	I feel appreciated by other students in this course.
3	I want to keep in touch with other students after this course is over.	I want to keep in touch with other students after this course is over.	I want to keep in touch with other students after this course is over.	I want to keep in touch with other students after this course is over.	I want to keep in touch with other students after this course is over.
4	I am reassured by other students in this course.	I am reassured by other students in this course.	I am encouraged by other students in this course.	I am encouraged by other students in this course.	I feel like other students in this course encourage me to do well.
5	Because of the actions of other students in this course, I can assume that I am respected.	Because of the actions of other students in this course, I can assume that I am respected.	I feel respected by other students in this course.	I feel respected by other students in this course.	I feel respected by other students in this course.
6	Multiple aspects of my identity are affirmed in my course, making it clear that I am more than a stereotype in this course.	Multiple aspects of my identity are affirmed in my course, making it clear that I am more than a stereotype in this course.	I feel like I am more than a stereotype in this course.	I feel like I am more than a stereotype in this course.	I feel like other students in this course accept me for who I really am.
7	I can be myself in this course.	I can be myself in this course.	I can be myself in this course.	I can be myself in this course.	I can be myself with other students in this course.
8	I feel understood by other students in this course when I share what I am thinking.	I feel understood by other students in this course when I share what I am thinking.	I feel understood by other students in this course when I share what I am thinking.	I feel understood by other students in this course when I share what I am thinking.	I feel like other students in this course understand me when I share what I am thinking.
9	I am supported by other students in this course.	I am supported by other students in this course.	I feel supported by other students in this course.	I feel supported by other students in this course.	I feel supported by other students in this course.
10	If I face challenges in this course, I can ask other students for help.	If I face challenges in this course, I can ask other students for help.	If I face challenges in this course, I feel comfortable asking other students for help.	If I face challenges in this course, I feel comfortable asking other students for help.	If I face academic challenges in this course, I feel comfortable asking other students for help.

Table B6 (continued)

Item	Original item	After expert review 1	After cognitive interview	After expert review 2	Final item
11	When I am underperforming, other students in this course will still consider me a valued member of the community.	When I am underperforming, other students in this course will still consider me a valued member of the community.	If I were to underperform, I would still feel valued by other students in this course.	If I were to underperform, I would still be included by other students in this course.	I feel included by other students in this course.
12	Despite times that I might make a mistake, I feel valued in this course.	Despite times that I might make a mistake, I feel valued in this course.	Even when I make mistakes, I feel valued in this course.		
13	I am comfortable making a mistake in front of other students in this course.	I am comfortable making a mistake in front of other students in this course.	I am comfortable making a mistake in front of other students in this course.		
14	I am comfortable sharing my thoughts with other students in this course.	I am comfortable sharing my thoughts with other students in this course.	I am comfortable sharing my thoughts with other students in this course.		
15	I find commonality with students in this course.				
16	I am recognized by other students in this course.				
17	I am open to developing collaborations with other students in this course.				
18	Other students in this course are genuine towards me.				
19	I mostly speak well of my experience in this course.				
20	I am proud to tell people in my life about this course.				

Table B7

Three-Form Survey Design

Instrument	Form		
	One	Two	Three
Brief Course Belonging Scale	X	X	X
University Belonging Scale – Affiliation		X	X
University Belonging Scale – Support and Acceptance	X		X
University Belonging Scale – Staff and Faculty Relations	X	X	
Expectancy -Value-Cost Scale	X	X	X
Social Connectedness	X		X
Loneliness	X	X	

Note. "X" denotes inclusion of items in the instrument/instrument subscale.

Table B8

Brief Course Belonging Scale

Item	Item phrasing	Response Choice			
BCBS1	I feel like my contributions during class activities matter to other students in this course.	Strongly Disagree	Disagree	Agree	Strongly Agree
BCBS2	I feel appreciated by other students in this course.	Strongly Disagree	Disagree	Agree	Strongly Agree
BCBS3	I want to keep in touch with other students after this course is over.	Strongly Disagree	Disagree	Agree	Strongly Agree
BCBS4	I feel like other students in this course encourage me to do well.	Strongly Disagree	Disagree	Agree	Strongly Agree
BCBS5	I feel respected by other students in this course.	Strongly Disagree	Disagree	Agree	Strongly Agree
BCBS6	I feel like other students in this course accept me for who I really am.	Strongly Disagree	Disagree	Agree	Strongly Agree
BCBS7	I can be myself with other students in this course.	Strongly Disagree	Disagree	Agree	Strongly Agree
BCBS8	I feel like other students in this course understand my ideas when I share what I am thinking.	Strongly Disagree	Disagree	Agree	Strongly Agree
BCBS9	I feel supported by other students in this course.	Strongly Disagree	Disagree	Agree	Strongly Agree
BCBS10	If I face academic challenges in this course, I feel comfortable asking other students for help.	Strongly Disagree	Disagree	Agree	Strongly Agree
BCBS11	I feel included by other students in this course.	Strongly Disagree	Disagree	Agree	Strongly Agree

Note. Instructions: Take your time reading each statement, consider your experience with other students in this course, then select the response that best represents your current beliefs.

Table B9

University Belonging Questionnaire

Item	Item phrasing	Response Choice			
University Affiliation					
UBQ1	I take pride in wearing my university's colors.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ2	I tend to associate myself with my school.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ3	One of the things I like to tell people is about my college.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ4	I feel a sense of pride when I meet someone from my university off campus.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ5	I would be proud to support my university in any way I can in the future.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ6	I have university-branded material that others can see (pens, notebooks, bumper sticker, etc.).	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ7	I am proud to be a student at my university.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ8	I attend university sporting events to support my university.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ9	I feel "at home" on campus.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ10	I feel like I belong to my university when I represent my school off campus.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ11	I have found it easy to establish relationships at my university.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ12	I feel similar to other people in my major.	Strongly Disagree	Disagree	Agree	Strongly Agree
University Support and Acceptance					
UBQ13	My university provides opportunities to engage in meaningful activities.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ14	I believe there are supportive resources available to me on campus.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ15	My university environment provides me an opportunity to grow.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ16	My university provides opportunities to have diverse experiences.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ17	My cultural customs are accepted at my university.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ18	I believe I have enough academic support to get me through college.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ19	I am satisfied with the academic opportunities at my university.	Strongly Disagree	Disagree	Agree	Strongly Agree

Table B9 (continued)

Item	Item phrasing	Response Choice			
UBQ20	The university I attend values individual differences.	Strongly Disagree	Disagree	Agree	Strongly Agree
Faculty and Staff Relations					
UBQ21	I believe that a faculty/staff member at my university cares about me.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ22	I feel connected to a faculty/staff member at my university.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ23	I feel that a faculty/staff member has appreciated me.	Strongly Disagree	Disagree	Agree	Strongly Agree
UBQ24	I feel that a faculty member has valued my contributions in class.	Strongly Disagree	Disagree	Agree	Strongly Agree

Note. Instructions: Below is a list of statements that may or may not be true about your experience at the university. For each of the following statements, please select the response that best indicates your level of agreement with that statement.

Table B10

Expectancy-Value-Cost Scale

Item	Item phrasing	Response Choice					
Expectancy							
EVC1	I know I can learn the material in my class.	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
EVC2	I believe that I can be successful in my class.	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
EVC3	I am confident that I can understand the material in my class.	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
Value							
EVC4	I think my class is important.	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
EVC5	I value my class.	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
EVC6	I think my class is useful.	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
Cost							
EVC7*	My classwork requires too much time.	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
EVC8*	Because of other things that I do, I don't have time to put into my class.	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
EVC9*	I'm unable to put in the time needed to do well in my [content] class.	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
EVC10*	I have to give up too much to do well in my class	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree

Note. Instructions: The following questions are about your attitudes towards this course. Please select the response that best represents your beliefs.
*Reverse scored

Table B11

Social Connectedness Scale

Item	Item phrasing	Response Choice					
Connectedness							
SCS1	I feel disconnected from the world around me.	Agree (1)	(2)	(3)	(4)	(5)	Disagree (6)
SCS2	I feel so distant from people.	Agree (1)	(2)	(3)	(4)	(5)	Disagree (6)
SCS3	I don't feel related to anyone.	Agree (1)	(2)	(3)	(4)	(5)	Disagree (6)
SCS4	I catch myself losing all sense of connectedness with society.	Agree (1)	(2)	(3)	(4)	(5)	Disagree (6)
Companionship							
SCS5	Even around people I know, I don't feel that I really belong	Agree (1)	(2)	(3)	(4)	(5)	Disagree (6)
Affiliation							
SCS6	I have no sense of togetherness with my peers.	Agree (1)	(2)	(3)	(4)	(5)	Disagree (6)
SCS7	Even among my friends, there is no sense of brother/sisterhood.	Agree (1)	(2)	(3)	(4)	(5)	Disagree (6)
SCS8	I don't feel I participate with anyone or any group.	Agree (1)	(2)	(3)	(4)	(5)	Disagree (6)

Note. Instructions: Below is a list of statements that may or may not be true about your relationships at the university. For each of the following statements, please select the response that best indicates your level of agreement with that statement

Table B12

UCLA Loneliness Scale

Item	Item phrasing	Response Choice			
UCLA1*	I feel in tune with the people around me.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way
UCLA2	I lack companionship.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way
UCLA3	There is no one I can turn to.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way
UCLA4	I do not feel alone.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way
UCLA5*	I feel part of a group of friends.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way
UCLA6*	I have a lot in common with the people around me.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way
UCLA7	I am no longer close to anyone.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way
UCLA8	My interests and ideas are not shared by those around me.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way
UCLA9*	I am an outgoing person.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way
UCLA10*	There are people I feel close to.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way
UCLA11	I feel left out.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way
UCLA12	My social relationships are superficial.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way
UCLA13	No one really knows me well.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way
UCLA14	I feel isolated from others.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way
UCLA15*	I can find companionship when I want it.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way
UCLA16*	There are people who really understand me.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way
UCLA17	I am unhappy being so withdrawn.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way
UCLA18	People are around me but not with me.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way

Table B12 (continued)

Item	Item phrasing	Response Choice			
UCLA19*	There are people I can talk to.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way
UCLA20*	There are people I can turn to.	I never feel this way	I rarely feel this way	I sometimes feel this way	I often feel this way

Note. Instructions: Take your time reading each statement, consider your experience with other students in this course, then select the response that best represents your current beliefs.
*Reverse scored.

Table B13

Proportion (in percentages) of Responses to the Brief Course Belonging Scale by Item Response Category

Item	Dichotomous		Polytomous			
	Disagree	Agree	Strongly Disagree	Disagree	Agree	Strongly Agree
BCBS1	14.8	85.2	2.0	12.8	56.7	28.5
BCBS2	13.4	86.6	2.0	11.5	52.8	33.8
BCBS3	26.6	73.4	1.6	24.9	43.9	29.5
BCBS4	15.4	84.6	1.3	14.1	49.2	35.4
BCBS5	7.2	92.8	1.0	6.2	52.1	40.7
BCBS6	10.5	89.5	1.3	9.2	54.1	35.4
BCBS7	11.1	88.9	1.0	10.2	53.4	35.4
BCBS8	8.5	91.5	1.0	7.5	58.7	32.8
BCBS9	18.0	82.0	1.6	16.4	46.9	35.1
BCBS10	19.3	80.7	3.0	16.4	46.2	34.4
BCBS11	14.4	85.6	2.6	11.8	52.8	32.8

Note. Strongly disagree and Disagree choices in the polytomous rating scale were collapsed to Disagree response choice in the dichotomous scale; Strongly agree to Agree choices in the polytomous rating scale were collapsed to Agree response choice in the dichotomous scale.

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THE NEW TEACHER PROJECT, Washington, DC
District Hiring Specialist, DC Teaching Fellows, May 2010 to September 2010

COLUMBIA UNIVERSITY, New York, NY
Head Counselor, Summer Immersion Program, Summers 2005 to 2008

PUBLICATIONS

Richardson, J. W., Hollis, E., Pritchard, M., & **Lingat, J. M.** (2020). Shifting teaching and learning in online learning spaces: An investigation of a faculty online teaching and learning initiative. *Online Learning, 24,* 67-91. https://doi.org/10.24059/olj.v24i1.1629.

Sindhvad, S., Richardson, J. W., Ivanov, A. & **Lingat, J. M.** (2020). Predictors of public school leadership capacity in Bishkek. *FIRE: Forum for International Research in Education, 6,* 24-44. https://doi.org/10.32865/fire202062184

Richardson, J. W., Sauers, N. J., Cho, V., & **Lingat, J. M.** (2019). Push and pull on Twitter: How school leaders use microblogging for knowledge mobilization. In J. R. Malin & C. Brown (Eds.), *The Role of Knowledge Brokers in Education: Connecting the Dots Between Research and Practice.* Abingdon, UK: Routledge.

Richardson, J. W., Nash, J. B., & **Lingat, J. M**. (2018). What do mobile-connected Cambodians do online? *Journal of Community Informatics, 14*, 85-108.

RESEARCH PRESENTATIONS

Lingat, J. M., & Toland, M.D. (2020, May). *Navigating the measurement of belonging: Current instruments and future opportunities.* Paper submitted for presentation at the annual conference of the Southern Association for Institutional Research, Point Clear, AL.

Lingat, J. M., & Parrish, E. (2020, May). *Homophonic assessment: Finding rhythm in distance education guidelines.* Paper accepted for presentation at the annual conference of the Southern Association of Colleges and Schools Commission on Colleges, Nashville, TN.

Rudolph, M. J., & **Lingat, J. M.**, (2020, May). *Using Bolman and Deal to Identify and Confront Challenges in Assessment.* Paper accepted for presentation at the annual Assessment Institute at Indiana University - Purdue University Indianapolis, Indianapolis, IN.

Lingat, J. M., Mantooth, R., Dueber, D. M., Li, N., & Toland, M. D. (2020, January). *Detecting gender-based & across campus differential item functioning on a sense of belonging scale in higher education.* Paper accepted for presentation at the annual conference of the American Psychological Association, Washington, DC.

Lingat, J. M., & Toland, M. D. (2019, October). *Measuring belonging in higher education: The Simple University Belonging Scale.* Paper accepted for presentation at the annual meeting of the American Educational Research Association, San Francisco, CA.

Lingat, J. M., Ryser-Oatman. J. T., Fisher, A., & Sampson, S. O. (2019, October). *Processing an innovative fraction learning program: A case study using teachers' perceptions.* Paper presented at the annual meeting of the Mid-Western Educational Research Association, Cincinnati, OH.

Lingat, J. M., & Rudolph, M. J. (2019, September). *Digging deeper: Using qualitative analysis for evidence and redesign*. Paper presented at the annual conference of the Southern Association for Institutional Research, Greenville, SC.

Rudolph, M. J., & **Lingat, J. M.**, (2019, September). *Exploring transfer student engagement using large-scale data.* Paper presented at the annual conference of the Southern Association for Institutional Research, Greenville, SC.

Lingat, J. M., Toland, M. D., Dueber, D. M., Love, A. M. A, Qiu, C., Wu, R., & Brown, A. V. (2019, August). *Demystifying positive and negative phrasing effects.* Paper presented at the annual conference of the American Psychological Association, Chicago, IL.

Toland, M. D., **Lingat, J. M.**, Qiu, C., Li, C., Ford, C., Chen, X., Han, J., Clement, T., Blevins, J., & Shen, L. (2019, August). *Measuring resident advisor self-efficacy: A differential item functioning study.* Poster presented at the annual conference of the American Psychological Association, Chicago, IL.

Lingat, J. M., Guskey, T. R., & Young, L. (2019, April). *Exploring the measurement of school leaders' collective efficacy and collective trust.* Paper presented at the annual meeting of American Educational Research Association, Toronto, Canada.

Lingat, J. M., Neat, E., & Rudolph, M. J. (2019, April). *Assessing student learning outcomes at a land-grant research institution.* Paper presented at the annual meeting of the American Educational Research Association, Toronto, Canada.

Richardson, J. W., Hollis, E., **Lingat, J. M**., & Pritchard, M. (2019, April). *Adopting e-learning teaching strategies at a research university: The voice of faculty members.* Paper presented at the annual meeting of American Educational Research Association, Toronto, Canada.

Richardson, J. W., Cho, V., Sauers, N., & **Lingat, J. M.** (2019, April). *Push and pull on Twitter: How school leaders use microblogging for knowledge mobilization.* Paper presented at the annual meeting of American Educational Research Association, Toronto, Canada.

Richardson, J. W., McLeod, S., Hurst, T., & **Lingat, J. M.** (2019, January). *Perceptions of educational leadership regarding open access publishing.* Paper presented at the annual meeting of the Hawaiian International Conference on Education, Honolulu, HI.

Richardson, J. W., Cho, V., Sauers, N. J., & **Lingat, J. M.** (2019, January). *Push and pull on Twitter: How school leaders use microblogging for knowledge mobilization.* Paper presented at the annual meeting of Hawaiian International Conference on Education, Honolulu, HI.

Lingat, J. M., Ryser-Oatman. J. T., Mazur, J. M., & Sampson, S. O. (2018, October). *Evaluating inclusive practices to empower military-connected students and families.* Paper presented at the annual meeting of the American Evaluation Association, Cleveland, OH.

Lingat, J. M.*, Turner, T. A., Worick, C. E., & Usher, E. L. (2018, April). *Patterns in metacognitive awareness: An investigation of undergraduate biology students.* Paper presented at the annual meeting of the American Educational Research Association, New York, NY. [Selected for 2018 Graduate Student Research Award from American Educational Research Association, Studying & Self-Regulated Learning Special Interest Group]

Sindhvad, S., Richardson, J. W., & **Lingat, J. M.** (2018, March). *Balancing instructional leadership and school management post-decentralization in Central Asia.* Paper presented at the annual meeting of the Comparative and International Education Society, Mexico City, Mexico.

Lingat, J. M., Herzing, J. L., & Usher, E. L. (2018, March). *Measuring collective efficacy in schools: A mixed methods exploration.* Paper presented at the annual meeting of the Spring Research Conference, Louisville, KY.

Malone, N. J., Hewlett, N. E., Zahrn, L. H., **Lingat, J. M.**, & Usher, E. L. (2018, March). *Intersecting identities: Perceptions of Black women at HBCUs and PWIs*. Paper presented at the Spring Research Conference, Louisville, KY.

Page, L. B., **Lingat, J. M.**, Ali, H. A., Usher, E. L., Patel, P. M., & Thomas, T. N. (2017, August). *Arabic students' speaking self-efficacy and its sources*. Poster presented for EARLI Biennial Conference, Tampere, Finland.

Lingat, J. M., Worick, C., & Usher, E. L. (2017, April). *Self-regulation skills, habits, and beliefs of undergraduate biology students.* Paper presented at the annual meeting of the Spring Research Conference, Cincinnati, OH.

Page, L. B., **Lingat, J. M.**, Thomas, T. N., Herzing, J. L., & Usher, E. L. (2017, April). *Spanish students' speaking self-efficacy and its sources.* Poster presented at the annual meeting of the Spring Research Conference, Cincinnati, OH.

GRANTS

Pasalar, C. (PI)., Radtke, R. (Co-PI), Mantooth, R., & **Lingat, J. M.** Advancing Collective Diversity Through Informal Learning Space Design in Higher Education: A Transdisciplinary Mixed Methods Approach. Sponsor: Spencer Foundation. Jan. 1, 2020 – June 30, 2021. ($49,901). Funded November 15, 2019.

ACADEMIC SERVICE

University of Kentucky Search Committees
- College of Education Faculty, October 2019 – May 2020
- College of Education Dean, October 2018 – May 2019
- Center for Graduate Diversity Associate Director, April – June 2018

University of Kentucky Graduate Student Congress, Lexington, KY
Student representative, August 2018 – August 2019

Universities of Cincinnati. Kentucky, & Louisville Spring Research Conference
Lexington, KY
Chair, October 2018 – March 2019

American Psychological Association, Washington, DC
Graduate Student Ambassador, March 2017 – August 2019
Reviewer, Winter 2018

American Educational Research Association, Washington, DC
Reviewer, Summer 2018, 2019

HONORS & AWARDS

Student Travel Grant, Southern Association of Colleges and Schools Commission on Colleges	**2019**
Larry G. Jones Travel Grant, Southern Association for Institutional Research	**2019**
Pillar Award, University of Kentucky Graduate Student Congress	**2019**
Workshop Award, The Society of Multivariate Experimental Psychology	**2019**
Graduate Student Award, American Evaluation Association	**2018**
University of Kentucky Outstanding Teaching Award, Department Nominee	**2018**
Graduate Student Research Award, AERA: Self-Regulated Learning SIG	**2018**
Showcased Student Presentation, AERA: Self-Regulated Learning SIG	**2017**
Lyman T. Johnson Diversity Graduate Fellow, University of Kentucky	**2016**
Highly Effective Educator, District of Columbia Public Schools	**2011-2015**
Education Pioneers Graduate Fellow: New York/New Jersey Region	**2011**
The New Teacher Project DC Teaching Fellow	**2009**
American University Graduation Honor: Charles W. Van Way Award	**2008**
Congressional Nomination for United States Military Academy at West Point	**2003**

AFFILIATIONS

Alpha Kappa Delta, International Sociology Honor Society
American Educational Research Association
American Evaluation Association
American Federation of School Administrators, AFL-CIO
American Psychological Association
Council of School Officers, Local #4
European Association for Research on Learning and Instruction
Kentucky Psychological Association
NAESP/NASSP: Federal Grassroots Network
National Association of Bilingual Education
National Association of Elementary School Principals
National Association of Secondary School Principals
National Council of Teachers of Mathematics
Omicron Delta Kappa, Leadership & Honor Society
Pi Kappa Alpha, Kappa Upsilon Chapter
Southern Association for Institutional Research
The New Teacher Project Alumni Advisory Board Member