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Undergraduate Student Sense of Belonging and EdTech Tool Engagement: A Mixed Methods Exploration of the Virtual Campus Experience

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National Louis University

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Veronica Wilson
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Approved:

Jaclyn K Rivard, PhD	Jaclyn K Rivard, PhD
Jaclyn Rivard, Committee Chair	**Jaclyn Rivard, Program Chair**
Shaunti Knauth	Carolyn Theard-Griggs
Shaunti Knauth, Committee Member	**Carolyn Theard-Griggs, Dean, National College of Education**
Bettyjo Bouchey	
Bettyjo Bouchey, Committee Member	
Jaclyn K Rivard, PhD	04/16/2024
Jaclyn Rivard, Dean's Representative	**Date Approved**

Abstract

The contemporary postsecondary learning experience is heavily mediated by educational technology (EdTech) tools and yet little is known about the ways in which these tools impact student engagement and sense of belonging, two indicators which are important to student persistence and graduation. Using Strayhorn's (2023) critical socioecological sense of belonging framework, this convergent mixed methods study offers insights into these relationships by examining student engagement with EdTech and student sense of belonging and the impact of student traits on the relationship between EdTech and sense of belonging. This study was conducted at a private, broad access Hispanic-Serving Institution in the Midwest with a large new majority student population: transfer, women, Students of Color, first-generation, commuter, parenting and employed. The participants (N = 301) included students taking in-person, online (asynchronous), and virtual (synchronous online) courses. This study validated a seven-item sense of belonging survey instrument. Multiple linear regression models tested EdTech use and reported sense of belonging and student demographic, academic, and non-academic labor traits and found three traits to have statistically significant predictive value on the relationship between EdTech engagement and sense of belonging: transfer status, social class, and caregiving responsibilities. Themes related to student traits, gratitude, service, and desired improvements emerged in the qualitative data analysis. These findings lend support for an ecological model to understand the dynamic relationships among student traits, institutional policy, practice, systems, and people, and external systems.

Keywords: Sense of belonging, student engagement, Hispanic-Serving Institution, EdTech, critical socioecology

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Dedication

To Anna, Lois, and most of all, Mama.

My first and best teachers. The ones who taught me love, strength, courage, faith, and hope.

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Chapter 1: Introduction

The postsecondary landscape in the United States continues to evolve as pressures mount for colleges and universities to realize the promise of being worth it. While earning a college degree continues to benefit students, gaps exist in college-going rates and degree attainment based on race, ethnicity, class, and gender. Change is also evident in how students complete their degrees. Students pursuing postsecondary credentials do so with substantial engagement in technology-enabled virtual spaces; in fall 2020 88% of postsecondary students were enrolled in at least some online coursework (United States Government Accountability Office, 2022) and a growing number of undergraduate students enroll in a combination of in-person and online courses (National Center for Education Statistics [NCES], n.d.a).

Institutions of higher education have a responsibility to their students to create environments which support their success, particularly colleges and universities with access missions. Supporting student success includes creating welcoming cultures that promote positive learning outcomes and persistence to degree completion. Among the factors which influence learning outcomes and persistence, sense of belonging, a feeling of mattering to the community (Hausmann et al., 2007), is a fundamental human need and motivation (Strayhorn, 2019; Baumeister & Leary, 1995). Sense of belonging includes both academic and social constructs. The absence of belongingness is associated with feelings of anxiety and emotional distress (Bresciani Ludvik, 2022), whereas a strong sense of belonging has been connected to greater comfort and resilience (Hoffman et al., 2002). Feeling valued is related to a sense of welcome, and is necessary for successful integration into the learning community and sustained academic engagement (Goodenow, 1993).

Student engagement is characterized by commitment, participation, and involvement in a student's learning and co-curricular experiences. A robust body of research exists on postsecondary student engagement because of its role in the learning process. According to Tinto's theory of student integration (1993), considered a foundational work in understanding student departure decisions, a student must fit within the institution. Hurtado and Carter (1997) importantly critiqued Tinto's premise that the student must acclimate—and for students from non-dominant cultures, assimilate—in order to fit. In recent decades research has expanded to understand the ways in which a more diverse student experiences the learning environment. Referred to as the new majority, these students have historically marginalized identities, such as low-income, women, commuters, transfer students, and Students of Color (Strayhorn, 2023). Campus climate and alignment with campus values have been shown to influence the academic outcomes and perceived sense of belonging for Latino/a/x, first-generation, and transfer students (Hurtado & Carter, 1997; Museus & Chang, 2021; Torres & Boeck, 2022).

As more is known about the experiences of a broader share of college-going students, efforts can be made to improve access to and outcomes in higher education. The use of technology is one way educators and policy-makers alike view as key to closing performance gaps (McMillan Culp et al., 2003). Research has linked computers and technology use with positive outcomes, such as promoting student engagement, effort, higher order thinking, problem-solving, and collaboration (Kuh & Vesper, 2001; Kuh & Hu, 2001; Gill-Simmen, 2021; Chen et al., 2010). Further, online and virtual delivery of educational experiences reach students who otherwise would be unable to matriculate or complete their college credential (Thomas et al., 2014). Some rural, transfer, and adult students are among those more likely to choose online coursework for the access and flexibility afforded to them. Flexibility should not be taken to

mean that the fundamental human need to belong is absent for online learners; two studies reported that online students desire sense of belonging to a community during their academic pursuits (Thomas et al., 2014; Peacock et al., 2020).

Education technology (EdTech) is viewed as a key component of, rather than a distinct form of, student engagement, yet there is much to understand about the efficacy of technology-mediated spaces for learning and engagement (Kuh & Nelson Laird, 2005; Bond et al., 2020; Ferdousi, 2023). Access to technology alone is not sufficient to improve student outcomes and to close equity gaps (McMillan Culp et al., 2003) and, quite the opposite, increased use of technology can widen learning disparities (Ahn, 2022; Kuh & Vesper, 2001). In light of the multi-billion dollar EdTech industry, it is incumbent upon postsecondary institutions to better understand the impact of technology on learning and engagement, as well as to identify technology dimensions of student engagement as predictors of student outcomes (Kuh & Nelson Laird, 2005; Ahn, 2022). A better understanding of how students experience EdTech is also critical for colleges and universities to develop coordinated, student-centered plans for using technology to promote access, engagement, and belonging.

Problem Statement

An ongoing culture of accountability amid scarce resources and economic precarity result in pressures for institutions of higher education to retain the students who matriculate. College retention literature is grounded in models of student integration and engagement (Astin, 1984; Tinto, 1993, 1999), which have been criticized for their lack of predictive ability and presupposition that successful integration requires students with marginalized identities to forego their cultural identity to assimilate to dominant campus culture (Longwell-Grice & Longwell-Grice, 2008; Hurtado & Carter, 1997; Museus & Chang, 2021). Moreover, Hispanic-Serving

Institutions (HSIs) have a unique opportunity to close college attainment gaps; in the 2021-22 academic year, HSIs enrolled 65.6% of Hispanic students, 24% of Black students, 21% of American Indian and Alaska Native students, and 4.5 million, or 30% of all undergraduate students in the United States (Hispanic Association of Colleges & Universities [HACU], 2023). While there is a growing body of research on the experiences of students at HSIs, more is needed to balance the historical overrepresentation in literature of the "traditional" 18-year old middle class White residential college student (Torres & Boeck, 2022; Strayhorn, 2023; Museus & Chang, 2021).

Just as the typical college student has changed, so too has the typical postsecondary learning environment. Previously physical, the contemporary student learning environment is heavily mediated by technology. Despite this shift, sense of belonging inquiry falls into two distinct bodies of research: sense of belonging in a physical campus or classroom environment and belonging and engagement in online spaces (Bond et al., 2020). A growing share of college students who complete their degrees do so through a combination of in-person and remote coursework (NCES, n.d.a). A special consideration of the relationship between belongingness and engagement with EdTech bridges the distinct bodies of research and helps to evolve more precise language to describe the student experience.

Finally, though technology promises to connect students, improve the student experience, and increase access to education, significant questions remain about the effectiveness of technology to achieve learning outcomes and improve engagement (McMillan Culp et al., 2003; Kuh & Nelson Laird, 2005; Kuh & Vesper, 2001). The impact of technology use must be understood so that the educational mission of postsecondary institutions is not subsumed by the desire for profit of a vast industry (Teras et al., 2020).

By exploring sense of belonging and engagement with EdTech tools of students enrolled in online and in-person courses at a Hispanic-Serving Institution, this mixed methods research contributes to an understanding of the relationship between belongingness and technology.

Purpose

The purpose of this study is to understand the relationship between undergraduate student sense of belonging and engagement with EdTech tools. Gaining insights into the relationship and identifying the factors which might moderate the relationship will contribute to the decisions institutional leaders, faculty, and student support staff make about which technology to use and how to use it. A necessary step in assessing the effectiveness of often costly digital tools involves understanding this relationship. Higher education administrators must ensure the investment in technology is having the desired effect on outcomes.

Importance

The research on student sense of belonging has grown in recent decades and there remains a gap in knowledge about the experiences of diverse students in general, and those attending Hispanic-Serving Institutions in particular. Despite the growing reliance on technology to deliver the postsecondary experience, much is unknown about how student use of technology interacts with their feelings of connection and mattering within the campus community. The results of this study will provide insights into this aspect of the contemporary student experience, which benefits college and university administrators as well as learning designers, faculty, and EdTech companies. The findings can inform decisions around policy and practice related to technology's role in creating an ecology of belonging.

Theoretical Framework

The framework guiding this study is the critical ecology of sense of belonging advanced by Strayhorn (2023) that shifts the burden of belonging away from the student by including the milieu shaped by institutional (policies, practices, environments) and structural (histories and systems) externalities of a student's postsecondary experience. Acknowledging the role of the organizational, institutional, and structural forces which influence sense of belonging at the individual level provides a lens through which the findings of this study are understood. Moreover, the variables used in data analysis, detailed in Chapter Three, reflect not only traditional student traits, such as gender and ethnicity, but also externalities, such as caregiving responsibilities and the number of hours worked weekly at a job.

In order to advance sense of belonging research in the contemporary technology-enabled learning environment, this study draws from historically distinct bodies of research which situated the learning experience in an assumed physical academic environment or in an online learning environment. Neither fully captures the contemporary postsecondary learning environment, therefore efforts are required to complicate the research in order to broaden what we know and how we define notions of engagement and belongingness. Further, extant research largely explores first-time college student and transfer student experiences separately, leading to a gap in knowing how these two populations with distinct needs experience the same institution at the same point in time.

Because this research explores student use of the EdTech tools which mediate the student experience of the campus itself, and because sense of belonging has been found to be experienced differently by students based on personal and institutional traits, an ecological framework is used. Burk and Pearson (2022) found that university students' class-level identity

forms through the relationship between the student and the environment. The identity is fluid and influenced by the social interactions and relationships in the class, identity of the instructor, and the context of these interactions. Student class identity shaped their perceived sense of belonging. Strayhorn (2023) used the lens of a critical ecology to capture the experiences of the new majority college student; incorporating the externalities of a student's postsecondary experience shifts the burden to belong away from the student to find their place and makes space for the influence of policies, practices, environments, and systems on the student. A critical socioecological viewpoint incorporates "institutional or broader societal and organizational currents that conspire to structure sense of belonging" (p. 258).

Seeking to acknowledge the role of the organizational, institutional, and structural forces which influence sense of belonging at the individual level, the data collection and analysis capture many of the variables that reflect students in the new majority: low-income, women, first-generation, parenting students, and students from historically minoritized racial and ethnic groups. The inclusion of questions on the survey instrument pertaining to student use of institutional EdTech tools reflect aspects of the campus traits: the environment in which students engage; the policies which result in the technology that is used and for what purpose; and practices around how technology is used and configured. These institutional traits cannot be directly measured, however, the outcomes of the data analyses use this critical lens for interpretation. Incorporating these traits is a way to avoid placing the onus of engagement and responsibility to belong on the student.

Research Questions

This study aims to answer:

1. In what ways does student engagement with educational technology (EdTech) influence undergraduate student sense of belonging?
2. What is the impact of student traits on the relationship between EdTech and sense of belonging?

Answering these questions expands the understanding of the ways in which technology serves to support or impede sense of belonging, as well as variables which shape that relationship.

Overview of Research Design

This research is a convergent mixed methods study using an online survey administered to currently-enrolled undergraduate students. The survey instrument includes questions to measure sense of belonging, campus climate, student engagement with EdTech tools, and student traits (demographic and external, further explained in Chapter 3; see Figure 2), including qualitative comments. The online survey will be open for two weeks in the winter term. Recruitment efforts include sending emails and texts to undergraduate students from the Undergraduate College (UGC) Dean's Office, verbal announcements to the UGC executive leadership team, posting flyers in physical campuses, and distributing digital flyers and announcements to faculty and staff to amplify the efforts.

The target population includes all degree-seeking undergraduate students enrolled in the UGC. Students attend courses in three modalities: traditional face-to-face (urban and suburban campuses), virtual (remote synchronous), and online (fully asynchronous). All campuses will be included.

The data collection is from a single point in time therefore correlational analyses will be performed. First, a response rate will be calculated and characteristics of the sample will be compared to the population for independent student trait variables such as student gender, race and ethnicity, and program major, to determine how well the sample represents the population. Descriptive statistics will include sample means and standard deviations of the construct of sense of belonging and for moderating variables. Frequency distribution of EdTech tool engagement will be used for insights into engagement by the student traits variables as well as across the sample. Independent *t* tests and analysis of variance (ANOVA) will be used to compare variance within each group of independent variables (sense of belonging and student traits). Any statistically significant correlational relationships will emerge. Finally, multiple regression will be used to analyze the influence of EdTech engagement and moderating variables with the reported sense of belonging. The analysis will determine the variables which explain variance in reported sense of belonging. Partial correlations will be used to determine the contribution of EdTech engagement on sense of belonging.

Definition of Terms

Engagement: Engagement is the time and effort students spend on educational pursuits, characterized by sub-constructs at the behavioral, cognitive, and emotional levels (Saenz et al., 2011; Henrie et al., 2015; Trowler, 2010), and is shaped by student motivation and well-being, as well as institutional policies, practices, and campus design (Astin, 1984; Kahu & Nelson, 2018; Kahu, Picton, & Nelson, 2020).

Student Engagement: Student engagement here refers to a student's commitment, participation, and involvement in their learning and co-curricular activities through the use of

technology-mediated spaces that connect students to instructors, other students, content, and campus support services (Henrie et al., 2015; Tinto, 1993; Martin & Bolliger, 2018).

EdTech: Education technology (EdTech) refers to websites, software, systems, and applications which create and support the academic contexts and experiences of the educational and co-curricular learning environment. The umbrella term encompasses learning management systems, social media, wikis and blogs, videoconferencing software, and virtual reality (Henrie et al., 2015; Bond et al., 2020). These technologies can include homegrown systems at institutions (which the author has experienced in some form as a higher education professional at multiple public and private non-profit postsecondary institutions), and, increasingly, EdTech companies offering services to aid postsecondary institutions in delivering the education experience to and retaining students.

Considering that students experience the institutional culture and ecosystem, which is enabled by technology, in this research the EdTech tools includes websites and apps which connect students to the learning environment, academic support services, and co-curricular experiences, and the faculty and staff who the students interact with to access these experiences and services.

Student Engagement with EdTech: Student engagement with EdTech for the purpose of this study will include student use of institutionally provided software (websites and apps) which the student uses for the purpose of completing direct academic experiences, such as accessing a course quiz or submitting a discussion post in the learning management system (LMS); indirect academic experiences, such as scheduling an appointment with a writing specialist or registering for a student leadership workshop; and co-curricular experiences, such as joining a student organization or registering to attend a campus event. The use of institutional

EdTech tools will be used as a proxy for behavioral, motivational, and self-efficacy constructs which facilitate engagement (Henrie et al. 2015; Bond et al., 2020). This broad definition is intentionally inclusive of the two distinct bodies of research on student engagement; one of traditional in-person college classrooms and co-curricular spaces and one of virtual, largely LMS spaces. Findings in this research may illuminate opportunities to explore a more specific aspect of student use of and interactions with EdTech tools.

First-generation: Within this study, first-generation refers to an undergraduate student who does not report having a parent or primary caregiver who has completed a college degree or higher (Longwell-Grice et al., 2016; Museus & Chang, 2021).

Hispanic-Serving Institution: A federally designated institution of higher education in the United States enrolling at least 25% Hispanic students. Designation is achieved through an application process and designated schools are eligible to apply for federal Title V grants (U.S. Department of Education, n.d.). In the 2021-22 academic year there were 572 HSIs (HACU, 2023).

Sense of Belonging: Defined as a fundamental human need (Baumeister & Leary, 1995) that is experienced as both a state and a trait (Gillen-O'Neel, 2019), sense of belonging is a complex construct (Hoffman et al., 2002). It is the perception of a student's experience of support by, mattering to, and connection with students, staff, and faculty (Strayhorn, 2019; Torres & Boeck, 2022), and trust that a student's needs will be met (Strayhorn, 2023). For racially and ethnically minoritized students, sense of marginality is the opposite of sense of belonging (Hurtado & Carter, 1997). Hoffman et al. (2002) referred to this connection as being part of "a network of mutual obligation," (p. 237) and found that a strong sense of belonging was connected to greater comfort and resilience. Sense of belonging is understood here to be both a

state, varying at the individual level by context over time, and a trait, varying from one person to another (Gillen-O'Neel, 2019). This research will explore sense of belonging at one point in time through an online survey.

Overview of Paper

This study will complicate the understanding of sense of belonging of the contemporary college student within the contemporary learning environment. Investigating the sense of belonging of a diverse student population at an HSI and the relationship between reported sense of belonging and engagement with EdTech tools has the potential to inform the ways in which students experience the virtual infrastructure of the learning environment, leading to implications for how institutions of higher education use technology to support student learning outcomes and persistence and leverage the promise of technology to broaden access. Chapter Two contains a literature review of sense of belonging, engagement, and EdTech to set a foundation for Chapter Three, the methodology of this mixed methods study. Chapter Four will detail the research findings, and finally Chapter Five will offer a discussion and recommendations based on the findings.

Chapter 2: Literature Review

Introduction

Student sense of belonging has been shown to have a strong link to academic achievement in educational settings, and a body of research in postsecondary institutions shows ties to sense of belonging and student persistence in the United States (Hoffman et al., 2002; Vaccaro & Newman, 2016; Strayhorn, 2019; Ellison & Braxton, 2022). This holds true across student identity and course modality (Museus & Chang, 2021; Peacock et al., 2020). Particularly since the COVID-19 pandemic, students pursuing postsecondary credentials do so with substantial engagement in technology-enabled virtual spaces, such as application and student services portals, learning management systems (LMS), and student engagement platforms. The lines between a traditional learning experience, with in-person classroom instruction, and fully online learning experiences, either with synchronous or asynchronous delivery, are increasingly permeable as a growing number of undergraduate students enroll in a combination of in-person and online courses (NCES, n.d.a). Various versions of online, blended, and hybrid learning environments emerged during the pandemic and institutions of higher education have not yet determined whether these changes were temporary or will have staying power, as there remains an enduring veneration of what Spire (2023) referred to as the student engagement ritual of "home to university and back again" (p. 197).

The digital technology required to deliver the contemporary postsecondary learning experience has been referred to as a "complex nexus of technology" (Bond et al., 2020). Gen Z students, born between 1995 and 2010 (Seemiller & Grace, 2016), make up more than 80% of full-time and 58% of part-time postsecondary enrollment in the United States (NCES, 2022) and have been described as viewing technology as merely part of "the fabric of their lives"

(Koulopoulos & Kelsden, 2016). Yet explorations of sense of belonging tend to be limited to the experience of the physical campus environment without special consideration of the ways in which EdTech interacts with the sense of belonging. A distinct body of research exploring digital engagement has remained focused on fully online courses and learners (Bond et al., 2020), without any connection to the experiences such students may have with a physical campus learning environment.

These distinctions reflect an outdated and dichotomous viewpoint of students either pursuing an online educational experience or a traditional experience in a physical classroom space. To move toward a greater understanding of the contemporary student who both expects and experiences a campus that is physical and virtual, it is important to bridge bodies of research and to complicate the definitions that exist so that the language used better reflects the postsecondary experience.

Institutions of higher education continue to grapple with changing enrollment patterns while serving an increasingly diverse student population with varied outcomes, in the midst of receiving ongoing critiques of the cost of a degree and questions of the value of going to college (Torche, 2011; Lowe, 2023; Daly & Bengali, 2014; Bennett & Wilezol, 2013; Archibald & Feldman, 2011; García Mathewson, 2018). Reduced public investment in higher education coupled with calls for greater accountability and results have contributed to more focus on retention at the institutional level (Mumper et al., 2016; Zumeta et al., 2012; Lowe, 2023). The benefits of earning a credential beyond the high school diploma have been repeatedly demonstrated through an analysis of the multi-generational Current Population Survey (Pew Research Center, 2014) as well as a study of intergenerational mobility analyzing longitudinal data of five national surveys (Torche, 2011). Challenges notwithstanding, the current context of

higher education foregrounds the opportunity for institutions to more carefully explore the environments in which every student can thrive. More focus on retention, graduation rates, and closing outcomes gaps ultimately benefits the student, particularly first-generation, low-income, nontraditional, and historically underserved learners which many colleges and universities have neither recruited as successfully nor served as well (Hoffman et al., 2002; Howard, 2010).

Access to an ever-growing body of data and EdTech advancements continue to transform education and the way students, staff, and faculty interact with and experience the institution. Understanding how all students experience the virtual spaces of an institution can improve insights into the factors which interact with a sense of belonging. This knowledge could also inform how to use technology applications in a more differentiated, learner-centered way.

Student Sense of Belonging

Sense of belonging has become an area of interest in recent decades and is grounded in theories and research outside of the postsecondary setting (Freeman et al., 2007). For instance, Baumeister and Leary (1995) described sense of belonging as a basic and universal human motivation, and further found a diminished sense of belonging to be associated with anxiety, depression, and emotional distress; relatedly, some measures of belonging include psychological well-being components (Bresciani Ludvik, 2022). Specific to the college environment, belonging involves integration socially and academically (Hoffman et al., 2002; Davis et al., 2019). Sense of belonging is psychological, a feeling that one is a valued member of the college community (Hausmann et al., 2007), and a belief that the community has a shared commitment to be together and meet the needs of each individual (Strayhorn, 2022). The term is described as being both cognitive and affective, referring to “perceived social support on campus, a feeling or sensation of connectedness, and the experience of mattering or feeling cared about, accepted,

respected, valued by, and important to the campus community or others on campus such as faculty, staff, and peers" (Strayhorn, 2019, p. 4). Strayhorn's definition grounds belonging in the middle of Maslow's (1954) hierarchy of needs, requisite for knowledge, and situates it as being influenced by the need Goodenow (1993) documented for students to feel valued and welcomed in order to successfully integrate into a learning community and to sustain academic engagement.

Investigating factors which influence a global sense of belonging and support among 353 middle school adolescents in New England, Goodenow administered the Student Opinion Questionnaire (SOQ) instrument in English, social studies, math, and science classes. Additionally, teacher-reported grades and efforts ratings of each student were collected. The SOQ included questions pertaining to student motivation in a class and student perceptions of the social-emotional quality of the class. Motivation was constructed by questions about expectancy of success and the value of the topic, and social-emotional quality of the class was constructed by the student's perceived sense of belonging and personal support by way of the Class Belonging and Support Scale. Perceived sense of belonging was highly associated with academic effort and grades, and also influenced student effort and expectancy of success. Perceived teacher support was the most important dimension in the perceived sense of belonging.

Sense of belonging has been described as a construct (Hoffman et al., 2002). Strayhorn (2019) identified the construct as having seven core elements:

1. "Sense of belonging is a universal, basic human need" (p. 29). The learning outcomes of higher education can only be achieved when students feel like they belong.
2. "Sense of belonging is a fundamental motive, sufficient to drive behavior" (p. 32). Seeking belonging causes individuals to act in ways which are both healthy and

unhealthy, and within an academic context, in ways which both support and impede academic achievement.

3. "Sense of belonging takes on a heightened importance" (p. 34) based on context and until students experience belonging will struggle to engage in the learning process.
4. "Sense of belonging is related to, and seemingly a consequence of, mattering" (p. 36). Sense of belonging is relational in nature. Positive feelings which lead to a belief that someone cares is requisite to the experience of belonging. The relational quality also leads to mattering and this desire for mattering serves as a motive.
5. "Social identities intersect and affect college students' sense of belonging" (p. 37). Identity salience is critical to understanding the unique and sometimes unequal ways in which students experience belonging.
6. "Sense of belonging engenders other positive outcomes" (p. 39). Fostering a positive sense of belonging among students results in behavior to avoid breaking such bonds.
7. "Sense of belonging must be satisfied on a continual basis and likely changes as circumstances, conditions, and contexts change" (p. 39). Though sense of belonging tends to stabilize over time, it remains malleable. Lack of belonging is connected to disinvestment in a community and diminished interest.

As the body of postsecondary research grows, sense of belonging is proving to be dynamic and complex (Hausmann et al., 2007; Vaccaro & Newman, 2016; Strayhorn, 2019; Means & Pyne, 2017; Gillen-O'Neel, 2019), echoing the notion of fundamental needs being both domain- and situation-specific (Maslow, 1968). Additionally, identity informs and shapes definitions and experiences of sense of belonging (Means & Pyne, 2017; Strayhorn, 2008; Vaccaro & Newman, 2022). For instance, reported sense of belonging fluctuated among lesbian,

gay, bisexual, and pansexual students (Vaccaro et al., 2017), and belonging comprised three separate factors for students with disabilities (Vaccaro, Daly-Cano, & Newman, 2015). Online students have reported a strong desire for sense of belonging to a community in their learning experience (Thomas et al., 2014; Peacock et al., 2020). And brief interventions promoting social belonging have been shown to improve academic outcomes (Walton & Cohen, 2011).

Undergraduate students experience distinct institutional and class-level sense of belonging (Freeman et al., 2007), and institutional and major sense of belonging (Davis et al., 2019). In an exploration of 238 first-year students at a public university in the Southeast United States, Freeman et al. (2007) discovered that a student's reported sense of belonging within a single classroom space was not found to influence their reported sense of belonging more broadly at the institution. Their findings further suggested that the most important variable related to sense of belonging is a student's perception of social acceptance by peers and quality of faculty interactions. Of the 238 students, only 22 did not identify as White, limiting the generalizability of the findings beyond other White students at similar institutions. Data collection took place in biology, psychology, and English general education courses at the end of a class session after midterm exams had taken place. The authors adapted the Psychological Sense of School Membership instrument with Likert-scale survey questions that included university-level items and class-level items. For class-level items students were asked to respond for the course in which they felt the greatest sense of belonging. Class- and university-level measures of belonging were found to be distinct through principal components analysis with varimax rotation, so the researchers developed four scales: class belonging, university belonging, professors' pedagogical caring, and social acceptance. Additional scales were developed for variables pertaining to motivation and instructor traits. Bivariate correlations, independent *t* tests,

analysis of variance (ANOVA), and regression analyses were conducted to determine the strength of any relationships among variables. The findings were consistent with the body of research on belonging of younger populations (Goodenow, 1993), however they did not provide clarity to the question of the relationship between sense of belonging at the class and institutional level or whether academic engagement or social acceptance have greater influence on sense of belonging. A more complex statistical model than what Freeman et al. (2007) used may be warranted (Museus & Chang, 2021).

In trying to improve predictive measures used by advisors of first-year students by incorporating reported sense of belonging in the first academic term, Davis et al. (2019) found differences when exploring two measures of sense of belonging: social belonging with respect to the institution, and academic belonging with respect to a chosen major. To measure sense of belonging the researchers developed a Sense of Belonging Index (SBI) which can be administered at key transition points in the student journey and combined with other predictive measures. The institution had a practice of administering an annual survey, from which the SBI was developed using social belonging and academic behaviors indices. The SBI results were sorted into quartiles and then grouped into categorical low, medium, and high belonging groups. Unspecified analyses were performed to determine the statistical significance and relationship between the SBI variable, grade point average, and persistence from first to second term of enrollment. Social belonging had a stronger relationship with retention than academic belonging and students in the low belonging group were strongly correlated with lower persistence. GPA was not strongly correlated with SBI. Non-response to the survey was correlated to non-retention, a notable finding for institutions seeking to develop risk models which can be applied in the first term of attendance (Aulck et al., 2019). Including non-respondents is also important

as persistence studies using survey methodology are limited by not having responses from students who have stopped attending class or may be unlikely to respond to invitations to complete a survey.

Transfer and Commuter Students

Much of the research on sense of belonging is focused on first-time-to-college students in their first year of study at bachelor's granting institutions (Strayhorn, 2023), in part due to the high persistence risk in the first year of study (Tinto, 1993, 1999; Hoffman et al., 2002; Thomas et al., 2014). The experiences of the new majority student, which includes parenting students, low-income, first-generation and students older than 24 years old, have been marginalized through scholarship and policy decisions (Strayhorn, 2023). By the numbers, the fall 2021 total headcount at United States community colleges reached 10.2 million students; of those, 6.1 million were taking credit-bearing courses and 4 million were attending part-time (American Association of Community Colleges [AACC]; 2023). At the baccalaureate level, 10.8 million students were enrolled full- and part-time in fall 2021 in the United States (NCES, 2023). Between fall 2010 and fall 2020, total enrollment in postsecondary enrollment fell for White, Pacific Islander, Black, and American Indian/Alaska Native students, whereas in that same time frame the number of Hispanic, Asian, multi-racial, and non-resident students all increased. Finally, the undergraduate transfer student enrollment in fall 2021 was at 1.2 million. Transfer numbers peaked at 1.5 million in fall 2010 (NCES, n.d.c).

Sense of belonging is defined differently for the new majority students as compared to first-time continuing generation college students who matriculate in bachelor's degree programs immediately following high school completion. For instance, community college students emphasized "the importance of connecting with others and the comfort associated with fitting in,

sharing experiences, and knowing others' names" (Cooner, 2019, p. v). Further, community college students' perception of being academically challenged was correlated with their sense of belonging (Cooner, 2019). Cooner developed a framework for community college sense of belonging using data from the Community College Survey of Student Engagement (CCSSE) and qualitative data from three community colleges. Competing priorities, in-group and out-group animus, exclusivity, and reluctance to integrate into the campus community were identified as detractors from belonging, yet for students with a strong sense of belonging, students reported higher levels of collaboration with other students and faculty and spent more time engaged with learning material.

The sample for the quantitative portion of the methodology involved 106,000 respondents from the CCSSE. Analyses were run to determine correlations between reported sense of belonging and demographic variables (age, gender, race/ethnicity) and academic variables (developmental course enrollment and first-generation status). The strongest positive correlation was found between sense of belonging and student academic engagement and student interactions with peers and faculty. The survey instrument included a question to evaluate the quality of relationships with other students at the college on a seven-point scale, with 7 being the highest score. Characteristics of students who were more likely to report the highest sense of belonging were: women, Native Hawaiian, Hispanic, married, students aged 25 and older, first-generation students, and students who reported extremely supportive familial support of their college enrollment. For the qualitative portion of the study, Cooner interviewed 24 students and 12 faculty and staff from three community colleges in the Mid-Atlantic region of the United States. Student participants were asked to define sense of belonging and the definitions included six themes: commitment to education, community, comfort, communication, commonalities, and

context. Students described factors that contributed to their sense of belonging which included physical space, religion and external support networks, technology and social media, academic communities, membership in athletic programs, informal groups, student interactions with faculty/administrators, and student engagement with the academic subject. The findings are limited due to lack of disaggregation of the survey data. Further, the reported data analysis provided basic correlations and results did not include alpha values, confidence intervals, or other results to determine statistical significance.

Transfer students, too, experience sense of belonging in different ways than their counterparts attending college for the first time. At a highly selective large public university, transfer students' sense of personal support was highly correlated with sense of belonging (Torres & Boeck, 2022). The researchers developed the Belonging and Personal Support Scale for Transfer Students. This was accomplished through conducting an exploratory factor analysis with a 13-item survey asking about adjustment, belonging, and support using a 5-point Likert scale. Eleven of the 13 items had high reliability and were kept in the scale and two factors, belonging and personal support, were correlated at .53 and accounted for 67% of the variance. To include qualitative data, 42 students were interviewed and three themes emerged. First, institutional barriers were perceived to mean transfer students did not belong at the institution. Second, transfer students described traditional support systems like campus events and student organizations as insufficient support mechanisms. Finally, transfer students relied more heavily on relationships outside of the institution for support, challenging the socialization construct of engagement and involvement frameworks upon which sense of belonging definitions are typically built. Giacalone and Perrelli (2022) noted that more research is needed specific to commuter students and a reframed sense of belonging is necessary to reflect the multiple

marginalized identities characteristic of this group. Additional research is also warranted to replicate the findings of Torres and Boeck (2022) at other and less selective institutional types.

First-generation Students

The definition of first-generation students is varied, though a common definition is that no parental figure attended college (Museus & Chang, 2021). Students who are first in their family to attend college experience the college environment in different ways than their continuing generation peers, and was a variable of interest in Museus and Chang's exploration of influences on sense of belonging. A campus environment survey was administered to all undergraduate students at a moderately selective large public research university in the Midwest. Students who self-identified as first-generation were included, for a total sample of 1,049 undergraduate students. The demographics of the sample were not representative of the overall institutional first-generation population, therefore proportional weights were introduced to offset the overrepresentation of women and Students of Color. Variables from the survey included race, age, gender, parental education level, credit hours completed, enrollment status, self-efficacy, and sense of belonging. Campus environment constructs were developed to measure common ground, relevant learning activities, relevant community service and giving back to students' communities, and spaces of collectivist orientation.

Museus and Chang developed a structural model based upon the hypothesis that four campus environment constructs are associated with validation of first-generation students, and that increased validation predicts greater sense of belonging. The authors used structural equation modeling to analyze the data. Their model explained 65% of the variation in validation, with perceptions of common ground showing the strongest positive relationship with validation, and 48% of the variation in sense of belonging, with collectivist orientations showing the

strongest direct positive relationship with sense of belonging. The research fell short of predicting longer-term academic outcomes like grades, persistence, or degree attainment, but added to the understanding of environment influencing belonging and the existence of mediating variables. To account for the latter, Museus and Chang suggested that complex statistical models are warranted to capture the various predictors.

Among first-generation and low-income (FGLI) students attending a large public Hispanic-Serving Institution (HSI) in California, psychological well-being, mindful self-compassion, and student perceptions of the degree to which they mastered learning outcomes were significant predictors of self-belonging scores on a post-course survey administered in a first-year experience college success seminar (Bresciani Ludvik et al., 2022). The institution espoused a "[commitment] to repairing institutional inequities" (p. 148) and as such, the one-credit hour college success seminar course underwent revisions and explicit learning outcomes were introduced related to metacognitive awareness, sense of belonging, psychological well-being, and mindful self-compassion. Course assessment plans included journal entries, focus groups, student and instructor course feedback, and pre- and post-surveys.

A cluster analysis was conducted on 350 matched surveys and showed significant differences existed between the two clusters across ethnicity, gender, and college choice. A stepwise linear regression demonstrated that psychological well-being, student's self-rated course outcomes mastery, and metacognitive awareness skill set were significant predictors of sense of belonging among women and Asian and Asian American students in the pre-assessment. Student's self-rated course outcomes mastery was also a predictor of sense of belonging among Pell-eligible, first-generation, Hispanic or Latino, and White students. Moreover, while Hoffman et al. (2002) found perceived isolation to be a meaningful dimension of a student/peer sense of

belonging construct among first-year college students, these results showed that it was the students' ability to identify with others who are also struggling that predicts belonging (Bresciani Ludvik et al., 2022).

Research of sense of belonging in first-year seminar courses dates to 2002 at a public university in New England when Hoffman and colleagues set out to develop a sense of belonging instrument to capture student/peer and student/faculty measures. They employed qualitative and quantitative methods. First, 24 focus groups of 15 to 30 students during class sessions of the required first-year seminar course set out to surface attitudes, values, beliefs, and in-depth understanding of institutional commitment and intention to persist, two themes which had emerged as important in prior institutional research. The research coincided with the launch of learning communities in which student clusters were enrolled in multiple linked courses, including the seminar and multiple academic courses. Learning community participants reported greater levels of peer academic support and not feeling alone.

A questionnaire was administered to 448 students in a psychology course, and 205 were included in the analysis for meeting the criteria of first-year students also enrolled in the first-year seminar course. The sample was predominantly White and living in on-campus housing. As with the qualitative data, differences emerged between students in standard courses and learning community courses: results showed a statistically significant difference across all 35 student/faculty items and across 47 of 50 peer/student items using *t* tests. Factor analyses revealed four factors to be most meaningful student/peer items, explaining 68.5% of the variance: (a) perceived classroom comfort, (b) perceived isolation, (c) perceived academic support, and (d) perceived social support. Among the faculty/peer items, factor analyses determined three factors to be most meaningful, explaining 73.3% of the variance: (a) empathetic

understanding, (b) perceived faculty academic support/comfort, and (c) perceived faculty social support/comfort. Additional factor analyses were conducted of the 26 meaningful items. Five factors accounted for 63.3% of the variance: (a) perceived peer support, (b) perceived faculty support/comfort, (c) perceived classroom support, (d) perceived isolation, and (e) empathetic faculty interaction.

Sense of belonging formed prior to matriculation for first-generation and low-income (FGLI) students who completed a college access program in high school and enrolled in seven predominantly White colleges and universities (Means & Pyne, 2017). The authors set out to identify the institutional support structures–academic and social–which increased belonging among FGLI first-time college students. Ten students chose to participate in the qualitative study throughout their first year; eight identified as Students of Color (Native American, Latiné, bi-racial, and African American) and two identified as White. Seven identified as women and three as men. The first interview occurred just prior to or in the early weeks of the first semester, the second interview took place at the end of the first semester, and the third interview was completed over the summer after the first year ended. All interviews were transcribed and then analyzed individually and comparatively; data were coded and recoded as patterns and themes emerged. Participants described campus experiences which were simultaneously friendly and hostile, raising questions about the contextual nature of support structures. Supportive faculty, scholarship programs, identity-based organizations, and academic support services were found to enhance the students' sense of belonging and students relied on such support structures to help overcome the experiences of hostility or messages which caused students to question their sense of belonging even prior to beginning their studies. The findings have limited generalizability due to the sampling methods, but demonstrates the importance of support structures in sense of

belonging of students who have been historically excluded from higher education, particularly low-income and racially and ethnically minoritized students. The findings also suggested that institutional type influences belonging and additional research is needed in this area.

Sense of Belonging Critical Socioecological Model

Using an organizational framework, Burk and Pearson (2022) explored sense of belonging in the postsecondary classroom setting as a way to understand the fluid class identity that emerges through the relationship between the student and the environment. The findings affirm that for the largely Caucasian student population surveyed, the traits of the instructor influence student sense of belonging. Notably, it was not just the social interactions, but also the specific context in which they took place, which influenced the students' perceived belonging. Relatedly, emerging out of over a decade of research on sense of belonging, Strayhorn (2023) advanced a critical socioecological model in which internal (individual) and external (institutional and structural) factors interact to produce the interpersonal, or cultural and community, experience for students. These interactions can either promote or inhibit a student's feelings of connectedness. A critical lens challenges the ways in which a student's lack of connectedness can be misattributed to personal deficiencies: not college ready, socially awkward, anti-social, and academically struggling. The lens, too, surfaces the assumption of a "campus bubble" which presumes all students experience strong and consistent family support, physical and psychological safety, and have basic needs met by typical definitions of family and home. This presumption is also reflected in Tinto's (1993) student retention model, a foundation to the student engagement literature which is further explained and critiqued in the Student Engagement section of this paper. Finally, a critical approach offers new language to complicate

the complex notion of belonging by explicitly incorporating the role of power and structural advantages in higher education.

Sense of Belonging in Online Spaces

Citing a lack of research on the sense of belonging and online learning, Peacock and colleagues (2020) conducted an exploratory study on the topic in order to be able to foster online learners' sense of belonging to reduce attrition. They discovered what they called *the complexity of the feeling*, which is "fluctuating, and ephemeral in nature, and differing for learners according to the context of their studies, individual needs, and self-efficacy" (p. 28). Their study also revealed that sense of belonging is important both to learners and instructors in online spaces; there is considerable influence of peers on sense of belonging for online learners; and engagement, culture of learning, and support were connected to sense of belonging. The research was conducted at a small university in Scotland and targeted postgraduate students enrolled in a fully online degree program. Sixty students from two academic programs were invited to complete an anonymous online survey with open-ended questions, and then at the end of the survey were invited to participate in a 45-minute semi-structured interview by phone. While only twelve surveys were completed and two participants completed the interview, the study was designed to be exploratory and further research is needed to replicate, refute, or complicate the findings.

The researchers used a thematic analysis for the survey responses and transcripts of the interviews were thematically analyzed using a concept map. Across all respondents, sense of belonging was mentioned as important to prevent isolation. The themes of engagement, culture of learning, and support were most prominent. With respect to engagement, the role of the *tutor*, a type of instructional staff member who plans course content and learning activities, was critical

to fostering a sense of belonging among the students. A tutor's perceived friendliness, helpfulness, and enthusiasm were also important. The theme of a culture of learning reflected positive and negative incidents which influenced the sense of belonging, such as access to online learning materials, module structure, and tutors' behaviors. The ability to share challenges and anxieties with other students by way of discussion groups was also tied to the sense of belonging, speaking to the importance of peer-to-peer relationship development. The final theme, support, was manifested through a connectedness to a peer group when feeling stress or navigating learning difficulties, and provided students with the resilience to continue in their studies. Despite the limitation of generalizability of the findings to undergraduate students due to the sample size and academic level of the sample, the exploratory study adds an important contribution to the literature and offers a starting point for additional research exploring online learning and sense of belonging.

Another exploratory study examined the role of fostering sense of belonging for online learners in Australia as a way to improve retention and learning outcomes (Thomas et al., 2014). Australia, like the United States, has seen a shift in demographics and greater diversification of its college-going population and the remote nature of online learning has helped to reach historically underrepresented students in Australia, such as rural, adult learners, primary caregivers, and students from lower socioeconomic statuses. A qualitative methodology identified challenges online learners faced and the strategies that support learning for non-traditional online students. Through a combination of 50 individual interviews and six focus groups, 67 first-year students and instructors participated from across numerous regions of Australia. Transcripts of the interviews and focus groups were generated and the data were coded after reaching inter-coder agreement. Sense of belonging emerged as a theme both with respect

to experiencing sense of belonging in online learning as well as with respect to online learning strategies that foster belonging. Further, as with the findings in the exploratory study by Peacock et al. (2020), participants expressed a desire to belong to a community in the online learning context, with some students initiating relationships and in-person meetings beyond the formal learning environment. Lack of sense of belonging was often described as feeling isolated, disengaged, or lonely.

Instructors reported the following effective strategies to promote a sense of belonging: ice breakers, connecting students to one another in the discussion spaces, connecting low-risk activities to students' professional experience, and "casualizing" the language. Courses designed for connection were found to be important to the instructor's ability to develop a learning community, otherwise incorporating best practices became cumbersome. Students reported feeling higher levels of satisfaction and learning in courses which nurtured a sense of belonging, characterized by varied opportunities for engagement.

Campus Climate

Research on campus climate investigates student perceptions of "the climate for racial/ethnic diversity, their experiences with campus diversity, and their own attitudes and interactions with different racial/ethnic groups" (Hurtado et al., 1998). Hurtado's campus climate theoretical framework emerged out of research of high-achieving Latino students at a Predominantly White Institution (PWI) and has been used to explain the external and internal forces which shape the experiences of minoritized students, though little research on campus climate has been conducted at Hispanic-Serving Institutions (HSI) or broad access institutional types (Cuellar & Johnson-Ahorlu, 2016). The external forces in the framework fall into two domains: government and politics and sociohistorical forces. There are four dimensions of

internal (institutional) forces of campus climate: historical legacy of inclusion or exclusion; structural diversity (numerical representation); psychological climate (perceptions and attitudes); and behavioral climate (intergroup relations) (Hurtado et al., 1998). Related to the numerical representation of a racial or ethnic group, those group members will experience the institution's diversity in different ways (Hurtado & Ponjuan, 2005).

A closer look at the foundation for the framework comes in Hurtado and Carter's (1997) research in which they tested a temporal path model to explain the effects of college transition and perceptions of campus racial climate on sense of belonging. One goal of the study was to better understand the factors which shape the integration and engagement of historically marginalized students, as the authors questioned the validity of Tinto's model, which will be described in the following section. Hurtado and Carter suggested that the campus racial climate affects psychological processes such as learning and hypothesized that there was a connection between a perceived hostile climate and sense of belonging for Latino students. Their model explored the new students' transition experience by gender, academic self-concept, and institutional selectivity, perceptions of a hostile racial climate, and sense of belonging. The longitudinal model included ways in which the variables would interact, for instance, "that perceptions of a hostile racial climate in the second year [would] have a negative impact on students' sense of belonging in the third year" (Hurtado & Carter, 1997, p. 331). They also tested the relationships between GPA and involvement in student organizations with reported sense of belonging. This distinction in engagement is noteworthy to capture feeling part of a group versus merely participating.

Using the 1990 cohort of the National Survey of Hispanic Students (NSHS) and a follow-up survey with items for sense of belonging, cognitive mapping, and ease in transition, the study

included 287 participants. Additional data were included from the Student Descriptive Questionnaire and national institutional databases. The final sample of 272 students was 58.1% female, 41.9% male, and 43.4% Chicano, 22.4% Puerto Rican, and 34.2% other Latino (Cuban, South, and Central American). A factor analysis reduced the number of variables in the model due to the sample size. Two-tailed tests and correlations were performed on student involvement and academic measures. The model showed a strong relationship between sense of belonging and engagement in academic conversations outside of the classroom, both with other students and with faculty. Additionally, participation in organizations (religious, fraternities and sororities, social-community, and cultural organizations) had a positive relationship with sense of belonging. Their model showed relationships among ease of transition, hostile climate, and sense of belonging, namely, that easier transition predicted perceiving a less hostile campus climate, negative perceptions of campus climate had a negative effect on reported sense of belonging, and the ease of transition had an indirect and positive effect on sense of belonging. This research was fundamental to understanding Latino student transitions and engagement and highlighted the importance of campus climate in sense of belonging, and therefore student outcomes. With a narrow focus on the experiences of high-achieving Latino students, this work has limited generalizability but has inspired other research on diverse student populations and institutional types.

One such study by Cuellar and Johnson-Ahorlu (2016) aimed to address the gap in knowledge of the perceptions of campus climate at HSIs in general, and at a community college in particular. Their work examined student perceptions of discrimination and bias based on race and ethnicity at a large HSI community college in the Western United States. The findings lend evidence to the growing understanding that campus climate is complex at institutions with

heterogeneous student populations. On campuses with a strong representation of historically minoritized student groups, the campus racial dynamics may include a culture of questioning a White norm. This culture may perpetuate stereotypical views of minoritized groups, which in turn shape a negative perception of the campus climate among minoritized students.

Cuellar and Johnson-Ahorlu applied the Multi-Contextual Model for Diverse Learning Environments (MMDLE) conceptual framework, a model in which campus climate is central to the academic experiences and success of undergraduate students, in their mixed methods research using quantitative data from one campus of a larger pilot administration of the Diverse Learning Environments (DLE) survey and qualitative data from concurrent student focus groups. All full- and part-time enrolled students who had completed one semester at the college were emailed a survey link and 818 students complete the survey. The respondents were 50% full-time, 67% female, 21% Asian, 64% Latino/a, and 15% White. A low African American response resulted in their exclusion from the analysis. The exclusion of African Americans perpetuates the lack of knowledge of Black students' experiences at HSIs. On HSI campuses that maintain a culture of centering whiteness with low enrollments of Black students, research has documented the efforts which Black male students in particular must take to endure racial microclimates, microaggressions, misperceptions, and discrimination in their academic pursuits (Brooms, 2023).

The discrimination and bias factor served as the dependent variable for Cuellar and Johnson-Ahorlu's research, created using nine items from the survey asking students about the frequencies with which they observed or experienced discrimination and bias. To determine any difference in perceptions of discrimination and bias, analysis of variance (ANOVA) was conducted and found significant differences by race in perceptions of discrimination and bias ($F = 28.86$, $p < .001$). Eligibility requirements for focus group participation matched the survey

requirements and students did not have to complete the survey in order to participate in the focus groups. Three focus groups were organized by racial and ethnic identity, with 21 student participants (White, 3; Asian, 12; and Latino/a, 6). The data were coded using cross-case analysis, first identifying quotes regarding experiences of discrimination of bias and experiences of fair and just treatment of students. Their analysis showed no significant difference between White and Latino/a students' reported levels of discrimination and bias, however Asian students reported significantly higher levels of discrimination and bias and more extreme cases compared to the other groups. Yet in the focus group, Asian students did not report any perceptions of discrimination and bias. The White student focus group had similar findings, whereas the Latino/a focus group described feelings of support as well as discrimination and bias.

This study shows the value of a mixed methods approach to a complex construct like campus climate. Although the sample sizes produced significant findings, the composition of the participants is a limitation, as not only were African American student experiences absent, but so too were multiracial and multi-ethnic students. The singular focus on one institutional type importantly shed light on the experiences of students at one broad access HSI community college, but there is limited generalizability and similar research at other similar institutions as well as more types of HSIs is warranted.

Research investigating the ways in which students from different racial and ethnic groups perceive the same campus environment in different ways is important to better understand how to support cross-cultural interactions which promote achieving equitable educational outcomes (Rankin & Reason, 2005). In a study of campus climate involving ten diverse institutions, Rankin and Reason (2005) administered a 55-item survey instrument (online and paper-and-pencil) to students, faculty, and staff, for a total sample of 15,356 responses, of those, 7,347 were

undergraduate students. Recruitment methods varied by campus, but with efforts to ensure statistical minority populations were well represented for statistical analysis. Due to small numbers of some racial and ethnic minorities, non-White students were categorized as "Students of Color" and data analyses compared the experiences of harassment and perceptions of campus climate between the Students of Color and White students.

A significantly higher number of Students of Color reported experiencing harassment (30% compared to 22% of White students) and whereas Students of Color were more likely to describe the campus climate to be racist and hostile, White students tended to experience the campus climate as nonracist and friendly. White students, too, were more likely to report classrooms and campus work settings as welcoming to Students of Color, and more likely to believe that the climate was improving. There was no difference between groups when it came to a belief that institutional efforts, such as required courses or workshops, would improve the campus racial climate. Student-on-student harassment was most common in the form of derogatory remarks, although faculty and staff, too, were reported as the perpetrators harassment.

In light of these findings, Rankin and Reason (2005) suggest that campus leaders assess campus climate and acknowledge that differences exist across racial and ethnic groups in perceptions of campus climate and experience of harassment. Due to the contextual nature of campus climate and differing experiences of the climate by racial and ethnic identity, more must be done to understand the climate on each campus and additional research is warranted at a broader range of institutional types to replicate the findings. A limitation of this study is the grouping of all non-White students into a "Students of Color" category. While this allowed for the inclusion of more minoritized groups to be included in the data, it did not provide insights into the differences across minoritized identities. Another limitation is a lack of qualitative data

to explain the stories behind the experiences. Including qualitative data is one way to explore perceptions and experiences more fully and seek commonalities and differences across identity. Finally, Rankin and Reason (2005) offer four types of institutional interventions: educational, such as trainings, workshops, and courses; symbolic actions, like institutional statements; fiscal commitments, such as money devoted to recruit and retain diverse faculty and staff; and administrative actions, like policies in support of recruiting and retaining diverse faculty and staff. While these actionable recommendations are logical, none included evidence-based practice, suggesting that research and assessment are needed to determine the effectiveness of such interventions on reducing harassment and improving campus racial climate. Returning to a previous note from Cuellar and Johnson-Ahorlu's (2016) research, a campus culture which questions the normativity of whiteness can perpetuate stereotypes of historically minoritized groups. These enduring stereotypes shape a negative perception of the campus climate by minoritized students, indicating that interventions must be carried out very carefully to have the desired effect.

Student Engagement

One of the most influential frameworks around student engagement was advanced by Vincent Tinto (1993), who theorized the process of a student's perceived integration into the college setting and how this perceived fit factors into a student's decision to depart from the institution. Engagement lacks a universal definition but is broadly accepted as a student's commitment, participation, and effortful involvement in their learning and co-curricular activities (Henrie et al., 2015; Tinto, 1993). Sub-constructs of engagement exist at the behavioral, cognitive, and emotional levels, and motivation and self-efficacy facilitate engagement (Henrie et al. 2015; Bond et al., 2020). Within student affairs research, engagement is often synonymous

with involvement and refers not to the academic experience but to the student co-curricular experience (Saenz et al., 2011; Young et al., 2019). Related areas of inquiry include student fit, retention and persistence, and departure, of which Vincent Tinto's (1975; 1993) framework is the most common.

Tinto's research has been broadly critiqued for its lack of validity and inability to predict student departure in general, and further for its premise that the responsibility to change, or integrate, rests on the student, a notion that is particularly problematic for historically minoritized students at Predominantly White Institutions (PWI; Brunsden et al., 2000; Tierney, 1999; Rendón, 1994; Saenz et al., 2011; Aljohani, 2016; Lee & Brown, 2010; Longwell-Grice & Longwell-Grice, 2008). Hurtado and Carter (1997) called Tinto's framework ambiguous in the lack of distinction between the behavioral interactions in the academic and social systems and the psychological affiliation with the campus. Therefore, using Tinto as a starting point, Hurtado and Carter developed a temporal model of Latino students' sense of belonging by exploring background traits and college experiences on belonging for Latino students. Notably, this work helped to lay the groundwork for Hurtado's contributions toward campus climate research. In this framework, they build upon membership replacing integration, as minority students occupy "multiple affiliations without adopting a single or predominant set of norms" (p. 327). They further sought to challenge Tinto's model by involving the external communities, from which a large number of college students do not separate to attend college.

Their study involved institutional data and survey responses from the National Survey of Hispanic Students and Student Descriptive Questionnaire, resulting in a sample size of 272 students at 127 colleges. The ethnic breakdown was 43.4% Chicano (Mexican American), 22.4% Puerto Rican, and 34.2% other Latino. Data analyses explored relationships between sense of

belonging and academic activity and participation in campus organizations. Controlling for selectivity, gender, and precollege self-concept, they found that sense of belonging was strongly correlated with frequent discussions of course content with other students outside of class. Maintaining family relationships was essential to the ease of transition in the first year, and the authors suggested ease of transition as an early predictor of sense of belonging for students who persist to their third year. Students in their third year who were involved in social-cultural and religious student organizations reported stronger sense of belonging, all of which are linked to affiliations external to the institution. Their model also proposed a Hostile Climate factor: they found a student's perception of a hostile racial climate in the second year had a negative effect on sense of belonging in the third year. Membership in racial-ethnic student organizations appeared to have a mediating effect on the hostile racial climate; however, a higher sense of belonging was not reported among members of racial-ethnic student organizations who did not perceive a hostile racial climate.

Although Tinto (1993) remains the standard, the sense of belonging model for Latino students (Hurtado & Carter, 1997) has become foundational to the understanding of the experiences of diverse students. Exploring first-year student sense of belonging among Latino, African American, Asian American, White, and multi-racial students, Johnson et al. (2007) used Hurtado and Carter's work as a conceptual framework in their research.

The lack of universal definition of student engagement, set within the contemporary context of an increasing reliance on technology to deliver the learning experience, produces an opportunity for research which moves toward better frameworks. Research such as this study, which will explore the relationship between technology use and sense of belonging, can help to achieve this. Just as sense of belonging research is shifting the onus to belong away from the

students, recent engagement research has shifted the focus to understand ways in which campuses might be more conducive to the engagement of students from diverse backgrounds, which shifts the responsibility to change to a shared undertaking, versus resting solely on the student (Johnson et al., 2009). Relatedly, Cooner (2019) identified four areas of focus for the campus to support student retention: (a) information, (b) support, (c) involvement, and (d) learning.

Within these frameworks, the technology-mediated virtual ecosystems of the campus experience are largely excluded. Models of engagement are largely focused on four-year college students. Community colleges are typically more committed to offering accessible education and serve an increasingly heterogeneous student population, including larger shares of first-generation, historically minoritized, and low-income students (Saenz et al., 2011). Seeking to create a typology of engagement for community college students, Saenz et al. (2011) defined engagement as "amount of time and energy that students invest in meaningful educational practices" (McClenney, 2006, as cited in Saenz et al., 2011, p. 239). The duty of engagement should not fall on the student, though; an element of engagement is "how an institution deploys its resources and organizes the curriculum, other learning opportunities, and support services to induce students to participate in activities that lead to the experiences and desired outcomes such as persistence, satisfaction, learning, and graduation" (Quaye, Harper, & Pendakur, 2020, p. 3).

As noted, student involvement is closely related to and oftentimes synonymous with engagement (Saenz et al., 2011), particularly within student affairs research. More recently, some have drawn a clear distinction between involvement and engagement, describing the former as an activity that is not necessarily characterized by emotional investment (Young et al., 2019), yet the demarcation is not widespread in the literature. Astin's (1984) student

involvement theory posits that engagement is influenced by what the student experiences before college, the institution or environment, and student behavior. Astin defined student involvement as "the amount of physical and psychological energy that the student devotes to the academic experience" (p. 297) and advanced the theory as a way to design more effective learning environments. The most important resources in determining whether a student will achieve developmental and learning goals are the time and effort expended toward the goals, and as such he called upon faculty and higher education administrators to realize the potential to influence how much time and effort students are exerting toward academic outcomes through policies, practice, and the design of campus.

Student involvement theory (Astin, 1984) emerged during a time of prolific writing on student development in higher education and is therefore distinct in its focus. Skinner and Pitzer (2012) built upon the ecological model of engagement to advance the notion that engagement is the connecter between curriculum and learning and is critical to a learner's motivation. Within this framework, engagement: is the path to academic achievement; shapes the student's psychological and social experience of school; and is critical to academic development. An important contribution is the consideration of the opposite of engagement, or disaffection or burnout. Signs of disaffection are both physical and emotional. Though Skinner and Pitzer's work is focused on K-12 learning environments, there are themes which could be explored within the postsecondary setting, such as *trajectories of engagement*, or a noted decline in engagement as students make progress through their K-12 experience and the general stability of engagement levels at the student-level, or *interindividual stability*.

More recently, Kahu and Nelson (2018) advanced the concept of the *educational interface*, or "psychosocial space within which the individual student experiences education" (p.

6), which includes the complex and dynamic nature of the interaction between the student and the institution of higher education. The theory proposes that the likelihood of engagement is predicted by four pathways: self-efficacy, emotions, belonging, and wellbeing. Using the construct, Kahu, Picton, and Nelson (2020) completed a year-long qualitative study of 19 first-year students at an Australian university involving 362 semi-structured interviews. The first interview occurred before the first semester began and then continued weekly throughout the first year. The authors completed three phases of thematic analysis and found student and institutional factors interacted with the four pathways; connections and overlaps occurred across the four pathways; and positive and negative cycles of engagement occurred.

Wellbeing was the strongest pathway and participants described physical and psychological components. Heightened wellbeing facilitated behavioral, cognitive, and emotional engagement. Both positive and negative emotions were associated with all three types of engagement and the emotions were found to be linked to self-efficacy and wellbeing. Self-interest, also connected to all three engagement constructs, influenced interest and enjoyment of academic content as well as motivation. Finally, students described belonging in three contexts: the university, the academic major, and the classroom. Belonging in the classroom and at the university were influenced by peer and faculty relationships, whereas students described belonging to their chosen major in relation to future goals, instructors, and background characteristics and perceived fit. The fit reflects the interaction between the student and the institution; a lack of control was a prominent theme in the second semester, leaving some students to feel alienated and others to feel determination and agency.

Kahu et al. (2019) described the relationships among the pathways and student engagement constructs as non-deterministic, and suggested that more research is needed to

understand the nature of the influence among the variables and if there is a perpetual cycle of engagement which can be fostered in the right circumstances. Additional research is also needed to replicate these findings in different populations, for instance in different countries and institutional types and with a more diverse set of participants.

Online Engagement

Out of a robust body of literature a threefold understanding of student engagement in online learning has emerged: student-to-content, student-to-instructor, and student-to-student (Martin & Bolliger, 2018). For online learners the virtual learning space is the prominent experience of the institution (Chen et al., 2010). Guidelines have emerged around the creation of spaces which support positive and interactive learner experiences. Professional quality standards exist, such as Quality Matters for Online Program Design (Quality Matters, 2017) and the Online Learning Consortium (OLC) Quality Scorecard (Online Learning Consortium, 2023). Peacock et al. (2020) also found that sense of belonging to be a priority among both instructors and students enrolled in fully online coursework. Participating in collaborative group work, student-facilitated presentations, integrated case studies, and courses designed to facilitate engagement have all been identified as best practices (Martin & Billiger, 2018; Peacock et al., 2020).

Written at a time when Facebook was relatively new, Heiberger and Harper (2008) explored the use of Facebook to add novel out-of-classroom experiences for students, enhancing learning and socialization. They apply the tenets of traditional higher education student involvement theory to what was at the time an innovative virtual space which included synchronous and asynchronous engagement opportunities for users. These tenets are:

- Involvement requires physical and psychological energy
- Involvement occurs along a continuum

- Involvement has both quantitative and qualitative features
- Development is proportional to quantity and quality of involvement; and
- Educational effectiveness is related to capacity to increase involvement.

Related to the last tenet, the purpose of services is to induce student involvement and services should be evaluated against their ability to do so. The authors suggested higher education administrators should use this same lens toward what they referred to as institutional Internet-based programs, among them WebCT and Blackboard, and compare student use of such programs against Facebook. Further, they suggested campus administrators evaluate Facebook's role in student retention and the opportunity to use the site to create smaller communities around shared identities, academic majors, or interests. A case is made for why investment occurs within the context of Facebook. Early research around the time of this chapter's publishing on student Facebook use and academic behavior showed that higher levels of weekly Facebook use was not related to less time spent on academic activities.

Henrie and colleagues (2015) reviewed 113 articles comprising a body of research on K-12 and postsecondary student engagement in what they referred to as "technology-mediated learning experiences" to determine how engagement is measured and the strengths and limitations of such measures. Notably, most of the articles lacked clear definitions of engagement, requiring a focus on how engagement was operationalized in the literature. The authors distinguish between engagement within and beyond the classroom, with their inquiry focused on the former. Their research presumed that good measures of student engagement are a necessary precursor to improved instructional design.

Engagement was found to have been commonly operationalized across behavior, cognitive, and emotional engagement, and more than half of the articles measured more than one

category of engagement. Just more than three quarters of the research operationalized engagement through student behaviors such as attendance, time logged into a learning management system, attendance submission, frequency of posts, and time spent creating a post. Cognitive engagement emerged among 43% of the articles, using qualitative measures such as demonstration of reflection, synthesis, or interpretation within student artifacts. Emotional engagement was more common in K-12 studies (63%) as compared to postsecondary research (31%) and was measured by social interactions, sense of community, positive and negative emotional displays toward learning, peers, and instructors. Surveys were commonly used and the most frequently named survey instrument was Indiana University's National Survey of Student Engagement (NSSE), often used to compare student engagement levels when students experienced different modalities and how differentiated technology applications can impact engagement levels.

As noted in the first paragraph of this summary, one of the limitations the authors surfaced was the lack of precision in definitions of engagement, particularly in light of cognitive and emotional sub-constructs of student engagement, a finding which also emerged in the work of Bond et al. (2020) in creating a systematic review of student engagement research. Relatedly, the decision to exclude research using terms other than engagement likely left out the growing bodies of research on data mining and analytics. Surveys, too, present limitations, one being that they are not ideal to measure engagement across time. Another concern with surveys is that students may experience them as disruptive of the very engagement researchers seek to understand. Yet the authors noted alternatives are often resource-heavy, such as observational methods, and longitudinal semistructured interviews, like those conducted by Kahu et al. (2020), extended over the course of a full academic year and involved hundreds of interviews.

Rashid and Asghar (2016) developed a path model which suggested that the right kind of technology use in academic environments can enhance student engagement, which can improve student learning. Further, they noted that poor technology integrations can have the reverse effects both on student learning and student engagement. Chen et al. (2010) explored the question, "Does the relative amount of technology employed in a course have a relationship with student engagement, learning approaches, and student self-reported learning outcomes?" and found that the use of course-related technology should be considered a type of student engagement. Their findings suggest that technology use is more important earlier in the college experience, as their analysis was based on NSSE data comparing first-year and senior-year survey responses. Perhaps the differences in first-year and senior-year responses could also be a reflection of how and when technology is introduced to students, particularly when new systems or upgrades are adopted by an institution or academic department after a student has begun their studies.

Education Technology (EdTech)

A steady increase in education technology (EdTech) across the education landscape in the United States since the 1980's has been referred to as a type of educational reform (Ahn, 2022). The two decades following the turn of the 21st Century saw a proliferation of "user-centered web applications and services [promoting social connectedness, media and information sharing, user-created content, and collaboration among individuals and organizations" (Wilson et al., 2011, p. 2). General Web 2.0 platforms have been categorized into six types: mashups, information-sharing sites, social networking, syndication, weblogs, and wikis (Wilson et al., 2011); for those specific to learning technologies, Bower (2016) identified 37 types, falling into 14 clusters. These clusters include but are not limited to text- and image-based tools; audio, video, and

multimedia production tools; digital storytelling tools; website creation tools; data analysis tools; assessment tools; and synchronous collaboration tools. While Web 2.0 technologies aim to support learning activities (Bower, 2016), they do not include learning management systems (LMS), which fall into the EdTech umbrella.

There do not appear to be EdTech classifications at the present time, despite the growing use of EdTech in the classroom learning experience. The types of tools discussed in the literature generally include e-mail, video, asynchronous discussion boards, and synchronous chat platforms (Kuh & Nelson Laird, 2005; Bond et al., 2020; Ferdousi, 2023), and software systems which have limits to configurations designed to provide content and services to a series of end users through an LMS or career and internship management service (Wan, 2021). The COVID-19 pandemic accelerated technology adoption when swift adjustments to remote learning and campus services were required in response to lockdown policies and campus closures (Teras et al., 2020).

One analysis estimated more than $8 billion were invested in EdTech in the United States in 2021, though this figure included education services and products adjacent to traditional education settings (Wan, 2022). EdTech companies can also be broken down by those which offer services directly to consumers, such as Course Hero, and those which offer services to colleges and universities, like Handshake (Wan, 2021). Just as institutional leaders are determining the appropriate balance to strike between hybrid, online, and in-person educational experiences, so too is the EdTech private sector engaged in questioning the role of traditional physical campus places, or estates, in the university of the future (Spire, 2023). Little data is available regarding the number of EdTech companies partnering with each institution or the total cost to institutions, in the form of implementation and annual contracts, consulting fees, licenses,

and the institutional personnel required to provide the technical support of system configuration and maintenance. Teras et al. (2020) cautioned that the business model of EdTech companies for profit can be at odds with the pedagogical best practices desired by educators.

There is a need to ensure the desire for profits does not stifle the educational mission of institutions of higher education (Teras et al., 2020) and to address lingering questions regarding the effectiveness of technology to serve as a change agent and to close performance gaps as well as a gap between the promise and achieved gains of technology (McMillan Culp et al., 2003). McMillan Culp and associates found across twenty years of policy research in education technology a persistent viewpoint of technology as being critical to national success and thriving in teaching and learning, yet little evidence to show that the desired change had been realized. More recently Ahn (2022) challenged the optimistic consensus of EdTech, or presumed benefits of its use on learning outcomes, by finding evidence of the negative gap and gap-widening effects in young children's learning over time. There is support for computer use having a mediating effect on learning outcomes in undergraduate students, though frequency of use of EdTech does not necessarily result in stronger outcomes (Kuh & Vesper, 2001). Given that representation has been shown to have positive effects on the academic outcomes of Hispanic students (Capers, 2019), efforts must be made to understand how Hispanic and other students with marginalized identities experience EdTech tools to avoid inequitable experiences.

Kuh and Vesper (2001) underscored that there are inequities related to student access to computers and technology and learning gaps could grow with the increased reliance on technology, yet their research could not rule out that participants in their study who showed the greatest gains in learning were predisposed to technology use as a result of greater pre-college access to technology. Policy recommendations, too, are clear that technology access in and of

itself is not responsible for improved learning (McMillan Culp et al., 2003). Another limitation to Kuh and Vesper's (2001) research was in using a survey, the College Student Experiences Questionnaire (CSEQ), which failed to distinguish among information technology applications, instead grouping together email, Internet, and web-based software.

EdTech tools span beyond the classroom learning experience. EAB, an education software and research firm and parent company of one of the EdTech tools of interest in this study, published a white paper with a framework called *Six Hallmarks of the Modern Student Experience* (Yardy et al., 2021). The Hallmarks reflect the student lifecycle from admission to career placement: 1. Customer Onboarding, 2. Frictionless Services; 3. Accessible Campus Community; 4. Flexible Academic Pathways; 5. Holistic Well-being; and 6. Proactive Career Preparation. It is noteworthy that EAB products map to these *Hallmarks*. Framing students as customers is not new in higher education, though there are concerns around the degree to which customer service is infused in the education experience, with some critiques of the infiltration of neoliberal values in the academic space and concerns about consumerism's effect on engagement and learning outcomes (Levin, 2005; Nixon et al., 2018; Bunce, Baird, & Jones, 2016; Bunce, Rathbone, & King, 2023; Bayless, 2023). In light of the billions of dollars invested in these technologies, these concerns are not unfounded. Yet, within a technology-enabled learning ecosystem, the Six Hallmarks centralize the student experience in a way that requires institutions to coordinate and plan for using the technology to promote access to and engagement in the learning community while achieving the stated learning and career outcomes.

Student Engagement and EdTech

Noting a lack of consistent definitions of what is meant by student engagement, Bond et al. (2020) conducted a systematic review and produced an evidence map of 243 research studies

of student engagement and educational technology in higher education spanning from 2007 to 2016 across 33 countries. Bond and colleagues set out to explore how the studies align with engagement theories; to identify indicators of cognitive, behavioral, and affective engagement and disengagement; and to capture what they referred to as the learning scenario, modes of delivery, and educational technology tools. The behavioral dimension of engagement was most commonly studied in 86% of the articles, followed by 67% and 56% of the studies reporting on affective and cognitive engagement, respectively. The indicators of engagement were involvement/participation, achievement, and positive peer and faculty interaction, whereas indicators of disengagement were largely absent and included frustration, opposition, and disappointment.

Consistent with the challenge Henrie et al. (2015) faced in their analysis of the literature, Bond et al. (2020) found many articles lacking explicit use of the term "student engagement" and rather than exclude, they opted to include articles which described engagement in the title or abstract, even if using different terminology. When definitions were provided, engagement referred most often to active participation in learning, followed by peer and instructor interaction, and then time and energy (Bond et al., 2020). More than half of the articles were not grounded in a theoretical framework and as many did not have a research question.

Research on the student use of education technology has been largely quantitative and focused on behavioral engagement (Bond et al., 2020), often limited to activity in the learning management systems (LMS), such as identifying the most popular day and time for students to access the LMS on a mobile device (Ortiz & Green, 2019). Cope and Kalantzis (2015) referred to the "data exhaust" (p. 194) now available through the LMS, including log-in, course access, page views, and time stamps. In better determining the impact of EdTech, measures of virtual

engagement will need to be explored in a way that moves beyond frequency and incorporates qualitative and mixed methods approaches. The work of Kuh and Nelson Laird (2005), further described below, identified variables of student information technology use associated with student engagement in effective educational practices, such as emailing a professor about an assignment, communicating with classmates online to complete academic work, and using the institutional library website to find resources for academic work. Another caution with respect to EdTech and big data in education is in placing a burden on teachers and student services staff to mine and analyze learning data upon implementing new technology tools (Li & Jiang, 2021).

Computers and technology have been found to promote student engagement, higher order thinking, problem-solving, and collaboration, (Kuh & Vesper, 2001; Kuh & Hu, 2001; Chen et al., 2010), as well as to increase student effort and cognitive engagement in a task (Gill-Simmen, 2021). These findings support a shift in thinking of the nature of education technology as a component of student engagement as opposed to a standalone form of engagement, an idea Kuh and Nelson Laird (2005) sought to understand using NSSE data from the 2003 online survey administration. With a sample of more than 60,000 students from 420 institutions, the authors analyzed responses to 18 technology group items and effective educational practice group items in the five following areas: academic challenge, active learning, student-professor interactions, enriching educational experiences, and supportive campus environment. As compared to the paper survey, the online respondent sample included fewer women, racially and ethnically minoritized groups, part-time, adult learner, transfer, and commuter students. Partial correlations, controlling for demographic traits, parents' education, major, class level, transfer status, major, enrollment status (full- or part-time), Greek letter membership, and student-athlete status, resulted in a positive association between engagement with information technology and all five

effective educational practice measures. Then a series of factor analyses were performed and a six factor solution emerged which showed survey items fell into two groups, one about active classroom participation and the other about student collaboration with peers for academic purposes.

Kuh and Nelson Laird (2005) concluded that future research and scales of student engagement should include measures of technology dimensions of student engagement. Such tools would enable institutions to identify predictors of student outcomes. They caution that research is needed to discover if there is value added to measuring student engagement or if the traditional measures are sufficient. A primary limitation of the research is in the generalizability of the findings due to the population not reflecting the new majority student population (part-time, commuter, transfer, adult learner, racially and ethnically minoritized).

Chapter 3: Methodology and Research Design

Introduction

Student sense of belonging continues to be an area of interest in educational research due to the links found between it and positive educational outcomes; a growing body of research of diverse institutional type and student population shows sense of belonging is a factor in persistence irrespective of student identity and course modality (Hoffman et al., 2002; Vaccaro & Newman, 2016; Museus & Chang, 2021; Peacock et al., 2020; Strayhorn, 2019; Ellison & Braxton, 2022). Hausmann et al. (2009) found that sense of belonging variables belong in persistence models for white and African American students. Through the construct of Maslow's (1954) hierarchy of needs, Strayhorn (2019) situates belonging in the middle of the hierarchy, where it is requisite for learning and influenced by the need to feel valued. Feeling valued is related to a sense of welcome, according to Goodenow's (1993) findings; this feeling is necessary to successfully integrate into a learning community and for ongoing academic engagement.

As noted previously, engagement in online spaces is commonly understood in a threefold manner: student-to-content, student-to-instructor, and student-to-student (Martin & Bolliger, 2018). In fall 2020 88% of postsecondary students were enrolled in at least some online coursework (United States Government Accountability Office, 2022). Even before the COVID-19 Pandemic required broader use of technology to deliver the educational experience, a growing share of postsecondary students across institutional type were taking a mixture of online and in-person or exclusively online coursework (NCES Blog Editor, 2021). The experience of technology mediated learning has become ubiquitous in higher education and more needs to be understood about the ways in which technology influences sense of belonging. Pertinent to the

notion of EdTech are the attitudes of educators around its use: technology use in education has been heralded as a great disrupter and democratizer with the promise of improved access and equitable outcomes. Yet EdTech has not been proven to effectively realize these promises (Ahn, 2023; Laufer et al., 2021).

In order to advance sense of belonging research in the contemporary technology-enabled learning environment, this study draws from historically distinct bodies of research of the physical and online learning environments. Further, extant research largely explores first-time college student and transfer student experiences separately; this study seeks to understand how these two populations with distinct needs experience the same institution at the same point in time. These efforts have the potential to complicate and broaden what we know and how we define notions of engagement and belongingness

An online survey was administered to undergraduate degree-seeking students enrolled at an urban private Hispanic-Serving Institution as pilot of a college's annual student survey (see Appendix A). The College seeks to understand campus climate, sense of belonging and support, and technology utilization, therefore the survey included questions pertinent to these topic areas.

Research Question

This study is designed to answer the research question: In what ways does student engagement with educational technology (EdTech) influence undergraduate student sense of belonging? A secondary research question is: What is the impact of student traits on the relationship between EdTech and sense of belonging?

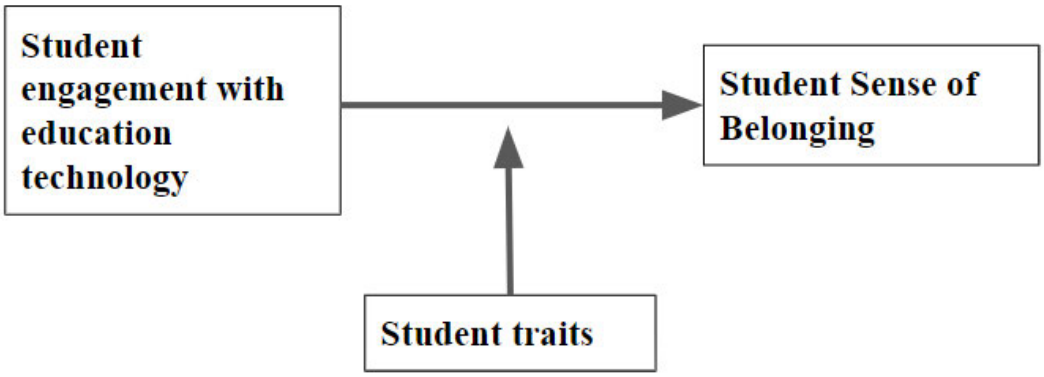
The null hypothesis is there will be no relationship between student engagement with EdTech and undergraduate sense of belonging.

The alternative hypothesis is there will be a relationship between student engagement with EdTech and undergraduate sense of belonging.

Conceptual Framework

Figure 1

Conceptual Framework of Student Engagement with EdTech and Student Sense of Belonging



Note. Exploring the relationship between student engagement with EdTech and student sense of belonging will include testing the influence of moderating variables within the ecosystem of structural systems and traits of the institution and individual.

Student engagement with educational technology (EdTech) is on the left of the conceptual framework inside a rectangle with a directional arrow to the right pointing to student sense of belonging inside a rectangle located at the far right of Figure 1. Student traits are inside a rectangle at the bottom of Figure 1 with a directional arrow pointing up to the arrow between student engagement with EdTech on the left and student sense of belonging on the right. In this framework student engagement with EdTech and student sense of belonging and student traits are independent variables and student sense of belonging is the proposed dependent variable. The arrow between the student's engagement with EdTech suggests a relationship with the student's perceived sense of belonging, and the upward arrow suggests a moderating variable between

student traits and the relationship between EdTech engagement and sense of belonging. A socioecological context provides a lens through which the relationship is understood.

Sense of Belonging

Sense of belonging is the dependent variable and is measured as a construct through an adapted seven-question Sense of Belonging in Higher Education Scale (Imperial College London). This survey was administered as a pilot in the institution's efforts to have one instrument to measure the perceived belonging and support within a classroom learning environment, at the institution, and within the context of relationships with peers, faculty, and staff (S. Lemons, personal communication June 12, 2023). Previously a college-wide survey was administered and was under review in the 2022-2023 academic year with a goal to administer a revised survey for the 2023-2024 academic year. One of the goals of the new instrument was to have a better tool to measure belongingness and perceived campus climate for historical use (S. Lemons, personal communication June 8, 2023).

EdTech Tool Engagement

Independent variables include EdTech Tool Engagement, as measured by self-reported use rates with three primary institutional EdTech tools: the learning management system (LMS), D2L, or Pulse; the student retention system student app, Navigate Student, or Navigate; and the student engagement platform, Eagle Life. EdTech Tool Engagement was created by summing the total reported use rates (Kuh & Vesper, 2001); individual use rates of each tool were also used as independent variables. Analyses were conducted to determine a correlation between individual website and app use and reported sense of belonging. Finally, analyses were conducted to determine the presence and strength of student traits as moderating variables on the relationship between EdTech use and reported sense of belonging. Additional information regarding the

variables and survey instrument questions is provided in the Survey Instrument section and in Figure 2.

Methodology

This mixed methods research used a multi-question survey to collect a large sample of data for analysis. Questions related to sense of belonging were adapted from the validated six-question Sense of Belonging in Higher Education Scale (Imperial College London, 2020), previously adapted and used to understand the impact of online learning on students' sense of belonging during the COVID-19 pandemic (Tang et al., 2023). Due to the racial and ethnic demographics of the population, additional questions were included to measure campus climate, a factor which Hurtado and Carter (1997) found to be meaningful to Latino college students' sense of belonging. The convergent design provided simultaneous collection of a large quantitative and qualitative data sample in order to merge the findings for a more complete understanding of the experiences of students across diverse academic circumstances (Creswell & Plano Clark, 2017). The research questions explored populations of students not typically studied together; this methodology was chosen for its potential to surface areas for further inquiry, including more in-depth qualitative research or a multi-phase mixed methods approach.

As students across modalities use common institutional EdTech tools (D2L, Eagle Life, and Navigate) which are used by the institution with the express purpose of engagement, these technologies are part of the institutional ecology in which students engage. Therefore, the survey instrument also included survey questions regarding the use (frequency and purpose) of these three tools. A series of questions about why students do or do not use each EdTech tool included a list of responses and an open "other" field. Finally, the instrument included open-ended questions that mapped to the conceptual framework and research questions. The choice to use a

convergent mixed methods approach with asynchronous qualitative data collection by way of the survey instrument, as opposed to more traditional approaches like focus groups or interviews, facilitated broad engagement from the entire sample over a short period of time.

Data Collection

The Undergraduate College (UGC) Student Survey (see Appendix A) is administered to all undergraduate degree-seeking students enrolled in the College on an annual basis. Historically the survey has been administered in the spring term, however the survey administration was paused in the 2022-2023 academic year and efforts have been underway to overhaul the survey to have a standard tool measuring belongingness while also addressing response rates, survey fatigue related to the biannual institutional administration of the Ruffalo Noel Levitz survey, and a desire to capture the voices of students who do not persist from fall to spring (S. Lemons, personal communication, June 1, 2023). Permission was secured by the Dean of the College to administer the survey. The survey included an informed consent statement. The data collection and analysis were approved by the IRB prior to administering the data or accessing any data (see Appendix D). To increase the response rate an additional reminder text and email were sent, which required receiving amended IRB approval (see Appendix E). After the survey closed the raw data were stored in a secure private folder with limited access on the institutional network.

The online survey was emailed to all enrolled undergraduate students from the UGC Dean's Office (see Appendix B). UGC Faculty and staff were notified of the survey and faculty were invited to post an announcement in the D2L Learning Management System, regardless of the course modality (in-person, synchronous online, and asynchronous online). Flyers with QR

codes to the survey link were emailed to UGC faculty and staff and posted in classrooms and in common spaces in the physical campuses.

Sample

The population included all degree-seeking undergraduate students enrolled in the Undergraduate College (UGC) at NLU, a multiple campus four-year private Hispanic-Serving Institution in a metropolitan area of a large Midwestern city. Total undergraduate enrollment of first-time and transfer students in the 2020-2021 academic year was 3,607; 54% Latino/a/x and 18% Black and African American, and approximately three-fourths of its students identified as women and a quarter identified as men (College Scorecard, n.d.). Students attend courses in three modalities: traditional face-to-face (urban and suburban campuses), virtual (remote synchronous), and online (fully asynchronous). In fall 2022 nearly half of the student population enrolled exclusively in in-person courses, 40% exclusively in remote or online coursework, and 12% in a combination of in-person and remote courses (NCES, n.d.b).

A convenience sample was used. Students who attend in-person courses had additional exposure to recruitment materials, although students who attend in-person may not attend to announcements in the LMS or email communication in the same ways as online or virtual learners who may pay closer attention to electronic communication. The UGC Dean's Office sent an email to all undergraduate students enrolled in the winter 2024 quarter inviting their completion of the survey and sharing the survey link with a recruitment flyer. There is a common sentiment that email is not an effective communication tool to reach students; in an effort to reach more students, faculty were provided with sample verbiage and the survey link for announcements across course modality. Further, flyers were printed and posted in the downtown urban and suburban campus locations featuring QR codes of the survey link. The survey was

scheduled to be open for two weeks, with an extension of up to one week to reach a desired response rate. Three days into the survey window, the Dean's Office sent a text with the survey link. Final reminders were emailed 72 hours and texted 24 hours prior to the survey closing.

Survey Instrument

The 36-question survey instrument includes the following sections: student sense of belonging, campus climate, engagement with the primary institutional EdTech tools, and student traits. Survey questions are mapped to the variables in Figure 2. The instrument includes a brief introduction with a rationale for the questions, as Lor et al. (2017) found this to be an effective strategy to reduce nonresponses among low-income and racial minority respondents.

Student Sense of Belonging

As noted previously, an adapted Student Sense of Belonging Scale in Higher Education measures sense of belonging. Each of the seven questions has a 5-point Likert scale with questions about the campus climate ("How welcoming have you found NLU to be?" (Not at all welcoming = 1, Extremely welcoming = 5)); peer, faculty, and staff perceptions ("How much respect do you feel other NLU students/faculty/staff show toward you?" (No respect at all = 1, A massive amount of respect = 5)); and global perceptions of the campus ("How much do you matter to others at NLU?" (Not at all = 1, Matter a massive amount = 5)). This instrument has been validated and used in multiple studies, yet as this was the first administration of these questions at NLU, analysis was performed to determine if the questions match what was asked.

Campus Climate

Campus climate involves two variables: student experience of discrimination and perceptions of racial-ethnic tension. The measures include questions about the experience of discrimination by faculty and other students based on Hurtado and Carter's (1997) research of

Latino student engagement and sense of belonging. Questions were expanded to encompass a broader range of marginalized identities ("I have heard professors make inappropriate comments about people because of one or more of their identities (race, ethnicity, gender, religion, sexual orientation, country of origin)" (Not at all; Sometimes; Never)). Perceptions of ethnic and racial tension included peer-to-peer dynamics ("Students of different racial/ethnic origins communicate well with one another") and student-to-administrator dynamics ("There is little trust between minority student groups and college administrators.").

EdTech Tool Engagement

A section of EdTech engagement includes questions pertaining to student use of three institutional EdTech tools: D2L web app and Pulse mobile app, Eagle Life mobile app, and Navigate Student web app and mobile app. Questions include frequency of use for each tool (daily, a few times weekly, a few times monthly, a few times each academic quarter, a few times each year, never). Total use across tools creates a comprehensive use measure. Additionally a question asks if students downloaded the mobile app (yes or no). No responses have a follow-up question asking why; yes answers have a follow-up question asking about used reasons:

- Eagle Life app: Sign up for campus events; Join student organizations; See NLU resources; Other.
- Navigate Student app: Class schedule; Schedule appointments; Study buddies; View holds; See NLU resources; Manage to do's; Other.
- Web-based D2L: I do not use the web version; Class schedule; View course content; Complete class assignments; Contact my professor; Contact my classmates; See NLU resources; Other.

- D2L Pulse app: Class schedule; View course content; Complete class assignment; Contact my professor; Contact my classmates; See NLU resources; Other.

Student Traits

Student traits variables are self-reported in the last section. There is contradictory evidence regarding the impact of including demographic questions at the beginning or end of survey instruments, however, Lor et al. (2017) reported that including demographic questions at the end of a survey is a strategy to insure participants are most attentive to the important questions of the survey. Additionally, using a statement that explains the reason the survey asks the questions was found to minimize non-responses.

The traits in the survey include demographic data, such as gender, ethnicity and race, first-generation status, and social class standing; academic traits, including program major, grade point average, course modality and campus, and class standing; non-academic labor traits, like work hours and caregiving responsibilities; and institutional commitment, a factor Hausmann and colleagues (2009) found linked to intention to persist. Program major is a free-response question with responses recoded to fit the College's three distinct major pathways: education, social and behavioral sciences, and business and technology.

Figure 2

Variables and Measures

Student Sense of Belonging	
Sense of Belonging Scale (Imperial College London)	How welcoming have you found NLU to be? (1 = not at all welcoming; 2 = slightly welcoming; 3 = somewhat welcoming; 4 = quite welcoming; 5 = extremely welcoming) How well do people at NLU understand you as a person? (1 = Do not understand at all; 2 = understand a little; 3 = understand somewhat; 4 = understand quite a bit; 5 = completely understand) How connected do you feel to staff at NLU, i.e. Advisor, Coach, Student Affairs staff? (1 = not at all connected; 2 = slightly connected; 3 = somewhat connected; 4 = quite connected; 5 = extremely connected) How much respect do other NLU students show toward you? (1 = no respect at all; 2 = a little bit of respect; 3 =some respect; 4 = quite a bit of respect; 5 = a massive amount of respect) How much respect do NLU staff show toward you? (1 = no respect at all; 2 = a little bit of respect; 3 =some respect; 4 = quite a bit of respect; 5 = a massive amount of respect) How much do you matter to others at NLU? (1 = do not matter at all; 2 = matter a little bit; 3 = matter somewhat; 4 = matter quite a bit; 5 = matter a massive amount)
Campus Climate	
Experienced discrimination–exclusion (Hurtado & Carter, 1997)	I have been insulted or threatened by other students because of one or more of my identities (race, ethnicity, gender, sexual orientation). (1 = Not at all; 2 = Sometimes; 3 = Frequently) I have heard professors make inappropriate comments about people because of one or more of their identities (race, ethnicity, gender, religion, sexual orientation, country of origin).

	(1 = Not at all; 2 = Sometimes; 3 = Frequently) I have felt uncertain about being welcome in a classroom because of one or more of my identities (race, ethnicity, gender, religion, sexual orientation, country of origin). (1 = Not at all; 2 = Sometimes; 3 = Frequently) I have felt excluded from school activities because of my race or ethnicity. (1 = Not at all; 2 = Sometimes; 3 = Frequently)
Perceptions of campus racial-ethnic tension (Hurtado & Carter, 1997)	There is a lot of campus racial conflict at NLU. (1 = strongly agree; 2 = somewhat agree; 3 = somewhat disagree; 5 = strongly disagree) Students of different racial/ethnic origins communicate well with one another. (1 = strongly agree; 2 = somewhat agree; 3 = somewhat disagree; 5 = strongly disagree) There is little trust between minority student groups and college administrators. (1 = strongly agree; 2 = somewhat agree; 3 = somewhat disagree; 5 = strongly disagree)
Engagement with EdTech Tools	
Technology use	Share how often you use these NLU technology: NLU Navigate Student app? (Daily, A few times weekly, A few times monthly, A few times each academic quarter, A few times each year, Never) NLU's D2L Online Campus (web or Pulse app)? (Daily, A few times weekly, A few times monthly, A few times each academic quarter, A few times each year, Never) NLU's Eagle Life app? (Daily, A few times weekly, A few times monthly, A few times each academic quarter, A few times each year, Never)
Technology connection	Share how connected you feel when you use NLU technology: Navigate Student app makes me feel connected to NLU staff, i.e. Advisor, Coach, Learning Support Specialist, etc.

	(I do not use this NLU technology; Strongly disagree; Somewhat disagree; Neither agree nor disagree; Somewhat agree; Strongly agree) Navigate Student app makes me feel connected to NLU staff, i.e. Advisor, Coach, Learning Support Specialist, etc. (I do not use this NLU technology; Strongly disagree; Somewhat disagree; Neither agree nor disagree; Somewhat agree; Strongly agree) D2L Online Campus (web or Pulse app) makes me feel connected to my professors. (I do not use this NLU technology; Strongly disagree; Somewhat disagree; Neither agree nor disagree; Somewhat agree; Strongly agree) D2L Online Campus (web or Pulse app) makes me feel connected to other NLU students. (I do not use this NLU technology; Strongly disagree; Somewhat disagree; Neither agree nor disagree; Somewhat agree; Strongly agree) Eagle Life app makes me feel connected to other NLU students. (I do not use this NLU technology; Strongly disagree; Somewhat disagree; Neither agree nor disagree; Somewhat agree; Strongly agree) D2L Online Campus (web or Pulse app) makes me feel connected to NLU. (I do not use this NLU technology; Strongly disagree; Somewhat disagree; Neither agree nor disagree; Somewhat agree; Strongly agree)
Navigate Student (EAB) app use	Do you have the Navigate app on a mobile device? (Yes, No) Yes: Which functions do you use in the Navigate app (choose all that apply): (View class schedule; Make appointments; Use study buddies; View holds; Look up NLU resources; Manage to do items; Other) No: What is the reason you have not downloaded the Navigate app?

	(I was not aware the app existed; I do not think the app will be useful to me; I previously downloaded it, but have since deleted it; I use the desktop version; Other)
D2L/Pulse app use	Do you have the D2L Pulse app on a mobile device? (Yes, No) Yes: Which functions do you use in the D2L Pulse app (choose all that apply): (View class schedule; Complete class assignments; Contact my professor; Contact my classmates; See NLU resources; Other) No: What is the reason you have not downloaded the D2L Pulse app? (I was not aware the app existed; I do not think the app will be useful to me; I previously downloaded it, but have since deleted it; I use the desktop version; Other) Which functions do you use in the desktop version of D2L's Online Campus? Check all that apply: (I do not use the web version; View class schedule; Complete class assignments; Contact my professor; Contact my classmates; Look up NLU resources; Other)
Eagle Life app use	Do you have the Eagle Life app on a mobile device? (Yes, No) Yes: Which functions do you use in the D2L Pulse app (choose all that apply): (Sign up for campus events; Join student organizations; Look up NLU resources; Other) No: What is the reason you have not downloaded the D2L Pulse app? (I was not aware the app existed; I do not think the app will be useful to me; I previously downloaded it, but have since deleted it; I use the desktop version; Other)
Student Traits	
Student type	What is your college experience? (Only NLU: This is my first term at NLU; Only NLU: I have been a student at NLU for more than this term; Transfer: This is my first term at NLU and I have taken college classes since high school somewhere other than NLU; Transfer: This

	is not my first term at NLU and I have taken college classes since high school somewhere other than NLU)
Program Major	What is your major? (Free response ___) Coded to business and tech; education; social and behavioral sciences
Gender Identity (ACPA Standards for Demographic Questions, 2013)	How do you describe your gender identity? (Free response ___; Prefer not to answer) Coded to Male, Female, Nonbinary, Undisclosed/Unknown
Age	How old are you? (Free response ___) Coded to Gen Z, Millennial, Gen X, Baby Boomer
First-generation status	What is the highest level of education completed by either of your parents or primary caregiver? Some high school; High school diploma or equivalent; Some college; Associate degree or certificate; Bachelor's degree; Master's degree (MA, MEd, MS, MBA, etc.); Professional or doctoral degree (PhD, JD, MD, etc.)) Coded to First-gen, Continuing gen
Race or ethnicity	What is your racial or ethnic identity? (American Indian or Alaska Native, Asian or Asian American, Black or African American, Hispanic or Latino/a/x, Native Hawaiian or other Pacific Islander, White, Two or More Races, I prefer not to respond, Other) Coded to American Indian or Alaska Native, Asian or Asian American, Black or African American, Hispanic or Latiné, Hawaiian or other Pacific Islander, White, Two or More Races, Unknown
Social class	Which term best describes your social class identity? (Wealthy, Upper middle class, Middle class, Working class, Low income or poor, Prefer not to say) (Recode to Working Class/Low Income/Poor, Wealthy/Middle Class/Unknown)
Grades	What is your current NLU GPA?

	(0-1.9; 2-2.9; 3-3.9; 4.0; I do not have an NLU GPA)
Course modality	What best describes your class schedule for this quarter? (In-person classes only; Zoom only; Online classes only; A combination of in-person, Zoom, or online classes)
Weekly hours worked	When school is in session, how many hours do you usually work each week at a paid job? Include on and off campus work. (0, 1-10, 11-20, 21-30, more than 30)
Caregiving responsibilities	When school is in session, what caregiving responsibilities do you have in a normal week? Choose all that apply: (None; Primary caregiver for my own child/children; Occasional caregiver of my own child/children; Primary caregiver for family members (sibling, cousin, parent, grandparent, aunt, uncle, etc.); Occasional caregiving for family members (sibling, cousin, parent, grandparent, aunt, uncle, etc.); Other) Coded to Caregiver (Primary), Caregiver (Any), Not Caregiver
Institutional commitment (Hausmann et al., 2009)	How happy are you with your choice to be a student at NLU? (1 = not at all happy; 2 = slightly happy; 3 = somewhat happy; 4 = very happy; 5 = extremely happy) How important is it for you to graduate from college? (1 = very important; 2 = slightly important; 3 = somewhat important; 4 = slightly unimportant; 5 = not at all important) Do you plan to complete your degree at NLU? (1 = yes, definitely; 2 = yes, probably; 3 = maybe not; 4 = definitely not)

Validity and Reliability

To ensure validity, reliability, and trustworthiness, first a pilot survey was administered with a sample population of institutional staff and faculty familiar with the population of interest and the research questions. Adjustments were made accordingly based on feedback; for instance,

how questions were interpreted, length to complete the survey, and the order of the questions. Additionally, survey responses were reviewed to ensure respondents were likely to have read and understood the questions, such as surveys with the same value for all responses. Analyses described in the following section were performed to check for reliability of hypothesized constructs for belonging, campus climate, tech connection, and institutional commitment.

In efforts to ensure trustworthiness, organized files were maintained of the open comment survey responses and the multiple rounds of data coding to capture the steps involved. A second rater coded the data to test the codebook for validity by using inter-rater reliability. The interview questions were written in a manner that mapped to the research question and each part of the conceptual framework (Anfara et al., 2002). This approach was designed to invite answers that would complement the understanding of the quantitative responses (Creswell & Plano Clark, 2017). Open questions were included throughout the survey for this same purpose. These efforts were aimed at achieving trustworthiness and openness in the qualitative research process (Anfara et al., 2002).

Variables and Data Analysis

As was established in Chapter Two, the student population is diverse with respect to race and ethnicity, new and continuing students, and includes a balance between first-time and transfer learners in multiple course modalities. To capture this diversity, demographic and self-reported student record information are used as variables (Aulck et al., 2019).

Student Trait Variables

To take into account factors which have been found to influence sense of belonging as a trait as well as academic outcomes, these student trait independent variables were included in the survey and analyses: first- and continuing-generation status, poor or low-income (Ferguson &

Lareau, 2021; Strayhorn, 2019), parenting status (Quaye, Harper, & Pendakur, 2020), work obligations (average weekly hours worked) (Strayhorn, 2019), and transfer status (Torres & Boeck, 2022).

The survey is anonymous and therefore student status and demographic information were self-reported. Demographic variables include gender (nominal), age (interval), race and ethnicity (nominal), and parenting status (nominal). Student status variables will include grade point average (interval), program major (nominal), course modality (nominal), and enrollment type (transfer or first-time-to-college or NLU Native; nominal). The body of research on sense of belonging has primarily focused on the experiences of first-time-to-college students yet transfer students have a different collegiate experience and understand support and belonging in a unique way (Torres & Boeck, 2022). In the United States in fall 2021, transfer student enrollment was just over 1.2 million (NCES, n.d.c) as compared to 2.6 million first-time degree-seeking students (NCES, n.d.d). The variables were categorized as demographic traits, academic traits, and non-academic labor traits (see tables 4.1, 4.2, and 4.3).

Data Analysis

Correlational analyses were performed, as the data collection is from one point in time and no interventions were performed. After the data collection period concluded, a response rate was calculated by determining the sample size and comparing it against the population. Incomplete surveys or surveys which suggested participants were not part of the targeted population or did not review the questions were excluded.

Descriptive statistics of interest include sample means and standard deviations of the construct of sense of belonging and for hypothesized moderating variables. These analyses determine the effect of the moderating variables related to the structural systems or individual

beliefs, mindsets, and identities in the critical ecology framework (Strayhorn, 2023). Additionally, the distribution of the sense of belonging measure will identify outliers and skewness. The standard deviation of the measure for the entire population will show any variation among the respondents.

Reliability of the belonging items was tested using Cronbach's α; and an average score of belonging items was generated for a Belonging value. Independent *t* tests were used to identify possible correlational relationships across student traits and Belonging. Analysis of variance (ANOVA) was performed to compare means for gender, race and ethnicity, campus, course modality, and college experience (first-term first-time, continuing first-time, first-term transfer, continuing transfer). These analyses would identify any statistically significant correlational relationships and the strengths of those relationships.

Linear regression models were used to analyze the influence of EdTech engagement and moderating student trait variables with the reported sense of belonging. The analysis would determine the variables which explain any variance in reported sense of belonging. Partial correlations were completed to determine the contribution of EdTech engagement on sense of belonging.

Limitations and Delimitations

Possible limitations of this study include the generalizability of the findings. There are few peer institutions that are broad access, four-year non-profit universities serving a majority minoritized student population. Moreover, offering in-person, virtual campus (synchronous remote), and online course options is not universal or permanent. Including additional institutions or replicating findings in other institutional settings would strengthen the generalizability. Another limitation is that the data is part of a convenience sample in which

students self-select to participate. Students who do not have a strong sense of belonging and those who are less engaged with technology, attend synchronous class sessions at lower rates, or who have serious time constraints on their schedule may be less inclined to complete a survey.

Relatedly, a delimitation pertains to the decision to administer the survey as anonymous, thereby excluding all non-respondents in the analysis. The decision was informed by the survey technology available and the historical practice of the College leaders to administer its annual survey anonymously. Non-response to a survey has been found to be correlated to non-retention (Aulck et al., 2019; Davis et al., 2019), therefore it could be worthwhile in the future for the institution to determine a survey administration method with identifying information for this purpose. Students who do not respond to the survey could have a weaker sense of belonging or may be less engaged, attend class at lower rates, or engage less with the EdTech tools, and the College could develop interventions to non-responders for retention purposes. As it stands, non-responders' views will be missing from the data and leave a gap in knowledge. Further, the sense of belonging measures do not reflect the specific ways in which transfer students experience belonging (Torres & Boeck, 2022) and may miss nuances between transfer and first-time students. A related delimitation is that sense of belonging is a complex construct that shifts over time and is context-bound, therefore the decision was made to measure sense of belonging globally for the population at one point in time. A final delimitation is two-fold and involves the timing of the survey administration. Original plans involved a fall survey administration, however resources were not available to achieve this timing. The decision was made to create and administer a survey specific to this research, the results of which will inform the final survey instrument and administration cadence in future years. A winter quarter survey administration

shortened the time period for data collection, which informed the decision to collect qualitative data through the survey instrument rather than through interviews or focus groups.

Researcher Positionality

Positionality shapes how individuals engage in decision making and is described as "one's formal position in a social system, as informed by all identities they have available to enact their agency" (Posselt et al., 2020, p. 60). While quantitative research has been historically viewed as traditional, rational, and free from bias (Provost & Fawcett, 2013), critical theorists like Griffin and Museus (2011) advanced the idea that quantitative and qualitative research alike involve the risk of applying a narrow focus on a singular dimension or misuse of data. Engaging in practices which avoid "totalizing and homogenizing" (Strunk & Hoover, 2019, p. 191) and applying an equitable mindset to all aspects of data collection and analysis will guard against these pitfalls (Griffin & Museus, 2011; Dowd & Elmore, 2020). Moreover, Jamieson et al. (2023) advanced that while the practice of reflexivity, or "examining one's own assumption, belief, and judgment systems, and thinking carefully and critically about how these influence the research process" (p. 1), is generally limited to qualitative research methodologies, adopting the practice in quantitative social science research incorporates more transparency, credibility, and rigor.

Common in quantitative social and behavioral sciences research, *postpositivism* is used as a theoretical perspective which asserts the objectivity of reality (Leavy, 2017). This drives the inquiry in and of itself: the survey instrument will be used to unearth knowledge and insights which were not available prior to this study. However, engaging in reflexivity in each step of the research process invites me to ask how I might be influencing the process (Jamieson et al., 2023), from data collection to data analysis and interpretation. In the data collection and data

analysis stages, theoretical, epistemological, and political positions can become enmeshed in power dynamics; accentuate in-group and out-group dynamics; or reinforce assumptions about the population through confirmation bias. One way to guard against confirmation bias is for researchers to "acknowledge their own perceptions of the research questions, goals, and hypotheses" (p. 8).

Viewing "the researcher as the data collection instrument" (Bourke, 2014, p. 2), it is important to understand this study from the context of the experiences which have brought me to study student sense of belonging and its relationship with EdTech tools. The seeds for this research were planted in the 2015-2016 academic year. Student protests took place at more than 80 campuses nationally (Trachtenberg, 2018) as Black students and their allies on college campuses, such as the University of Missouri, became emboldened to demand racial justice. A year prior the 2014 murder of Michael Brown served as a watershed moment in race relations in the United States and the subsequent calls for justice and spread of Black Lives Matter as a movement and as a hashtag carried over onto college and university campuses.

I worked at a private Predominantly White campus in a major metropolitan setting in the 2015-2016 academic year. Many Black students on campus came together to demonstrate, protest, and make demands of campus leaders (Bryne, 2015). Demands included more culturally relevant coursework and social justice learning outcomes across the curriculum. The mandatory first-year seminar, taught and owned by the department in which I worked, was called out as needing stronger ties to the social justice mission of the institution. That experience shaped my understanding of what it means for students to feel a sense of belonging on campus and in the classroom, though I had not yet formally studied these notions. Years later when I began my

doctoral journey, I was primed to be concerned with all of the pieces which influence belongingness and the ways justice connects to student outcomes.

I later transitioned to a new job at a broad access university where I still work and conducted this research. The typical students have been largely overlooked by four-year universities; they are predominantly commuters, transfers, racially and ethnically minoritized, returning degree completers, first-generation, low-income, and women. My understanding of what it means to design learning experiences for students expanded as I served a largely online student population; I considered how students experience the campus community and in what ways traditional, in-person experiences exclude students who require the flexibility of remote learning. I became attuned to the ways in which coordinated use of technology and human support promotes equitable outcomes (Bouchey et al., 2022). In managing both operational and direct student retention work, my research interests have coalesced into studying sense of belonging and engagement with EdTech tools.

The experiences throughout my career in higher education have resulted in a belief that student sense of belonging is critical to the success of students and institutions of higher education are better equipped to foster belonging when they design spaces in student-centered ways. Technology has great potential to connect students to the content, people, and resources on campus, but when not implemented well, this same technology can create barriers to successful outcomes and retention for some. It is also noteworthy that my current role is that of a senior leader where the research will be conducted and previously served in capacities that supported students who are part of the population of interest. This gives me insights into the student population and has greatly informed the research questions and variables. The positionality also required careful efforts in the research design to ensure students, faculty, and staff were able to

participate freely. Finally, the steps to maintain reliability and validity in the data analysis were particularly important due to my familiarity with the student population and institution.

Conclusion

In addition to the aforementioned benefits of complicating traditional notions of engagement and sense of belonging, the data collected by this survey benefits the institution by having a tool to measure sense of belonging and campus climate, which can be used to gather historical data in its efforts to better serve students. As an access institution that strives to redefine excellence, this can be achieved as administrators understand how students are experiencing the institution. The institution is also marked by innovation, which can go hand-in-hand with technology use. Educators in the United States have a bias toward viewing technology as progress and seeing it as the means to close gaps; at an access institution it is critical to have insights into the use and impact of its technology to ensure these promises are realized. Findings of this study will be detailed in Chapter Four. Additionally, the results will be shared with the Dean of the Undergraduate College and its executive leadership, as well as with institutional campus administrators whose work directly supports student belonging.

Chapter 4: Results

Introduction

This chapter presents the results of the survey administration and subsequent data analysis of responses which sought to answer the primary research question: In what ways does student engagement with educational technology (EdTech) influence undergraduate student sense of belonging? And the secondary research question was: What is the impact of student traits on the relationship between EdTech and sense of belonging? Of a population of 3,197, there were 302 students respondents for a survey response rate of 9.45%. The survey was open for three weeks during the beginning of the winter quarter. Provided in the following sections are qualitative and quantitative data. Quantitative data and analyses include descriptive statistics and frequencies of the dependent and independent variables; unidimensional reliability analyses of dependent variables to test similar items on the survey which were used to determine a belonging construct variable and campus climate variable; analysis of variance (ANOVA) to determine statistically significant relationships between independent and dependent variables; and regression models to show the relationships among the independent and dependent variables and the proposed moderating variables. Qualitative analyses include thematic analysis of tech use reasons and open feedback comments, as well as cross-case analysis to identify overlapping and contrasting themes based on the student traits (Cuellar & Johnson-Ahorlu, 2016) which were found to be statistically significant in the regression models.

Quantitative Results

A summary of the quantitative results follows, first with descriptive statistics, including the student traits by three categories: demographics, academic traits, and non-academic labor traits; then the reliability analysis used in determining constructs of the belonging dependent

variable; ANOVA of student trait independent variables and the dependent variable; EdTech use variable constructs; and finally, the multiple linear regression models.

Population Student Traits Descriptive Statistics

Descriptive statistics of the survey respondents are provided including frequency tables and mean, median, and mode of variables of interest. A big picture overview demonstrates that the students represent the new majority student: majority student of color, older than 25 years of age, low-income/working class/poor, female, first-generation, employed more than 20 hours weekly, and having caregiving responsibilities. More than half of the students identified as transfer versus NLU native and were enrolled exclusively in asynchronous online courses. All student traits are described in tables 4.1, 4.2, and 4.3 with descriptive statistics for variables of interest in the following sections.

Demographics. A minority of respondents (37.2%) were below the age of 25, or the age range commonly considered to be traditional college students. The median age was 30 and the mode was 19. The highest reported age was 75 and 26.3% of the students were 45 years or older. Students were grouped into a generation variable (Gen Z, ages 17–27; Millennial, ages 28–43; Gen X, ages 44–59; and Boomer, ages 60–75) in order to test differences across tech use and reported belonging based on literature suggesting differing attitudes around tech use for tech natives and the impact of anxiety and cyberphobia on the outcomes of some online learners (Koulopoulos & Kelsden, 2016; Ferdousi, 2023).

Male students were 18.3% of the respondents while 78.1% identified as female and .6% were non-binary. The gender survey question was fill-in, requiring the data to be coded. Male was used for any version of male or man; female for any version of female, woman, her/hers; and non-binary for any version of non-binary, they, or questioning. There were 2.9% of

responses coded as undeclared or unknown. These included any version of "prefer not to answer" as well as those for which gender identity was unclear, such as "Caucasian" and "Mexican". The largest racial group was Black and African American (33.2%), followed by Hispanic/Latiné (29.9%), White (20.2%), Asian or Asian American (9.9%), and two or more (2.3%). American Indian or Alaska Native was $n = 1$ (<.01%) and was excluded from the linear regression model due to the small sample size. Undeclared responses were those that checked "prefer not to share" or a free response akin to non-disclosure, such as "it's secret" (4.3%). The last racial and ethnic category resulted from recoding free responses that described an ethnic or cultural group or nationality, such as "North African," "Assyrian," and "Middle Eastern" (2.3%).

The majority respondents identified as poor, working class, or low-income (PWCLI; 60.5%) and 37.54% identified as middle class or wealthy. Free response answers were recoded to unknown (1.9%) and included "n/a," "don't know," and "does not matter," with the exception of "below the poverty line," which was recoded as PWCLI. First-generation (FG) students made up 87.37% of the sample and continuing-generation (CG) students were 12.6%. FG status was determined by coding survey responses of "some high school," "high school diploma or equivalent," "some college," and "associate degree or certificate." Continuing-generation status was determined by coding survey responses of "bachelor's degree," "master's degree (MA, MEd, MS, MBA, etc.)," and "professional or doctoral degree (PhD, JD, MD, etc.)."

Academic Traits: Student Type, Course Modality, and Major Type. Three independent variables describe academic student traits: student type (transfer or NLU native), course modality, and major type. More students identified as transfer (52.2%) as compared to NLU native (47.8%). Students in their first term at NLU made up 24.9% of the total sample, 11.9% NLU native and 12.7% transfer. First-term and continuing variables were created by

Table 4.1

Student Traits Frequencies: Demographics

N = 301 students	N	Percent
Age (years)		
17–24	112	37.21
25–34	57	18.94
35–44	52	17.28
45–54	59	19.60
55+	20	6.64
Generation		
Gen Z	137	45.51
Millennial	83	27.57
Gen X	73	24.25
Boomer	8	2.66
Gender		
Female	235	78.07
Male	55	18.27
Non-binary	2	0.66
Undeclared or Unknown	9	2.99
Race		
American Indian or Alaska Native	1	<.01
Asian or Asian American	21	9.98
Black or African American	100	33.22
Hispanic/Latiné	90	29.90
Other – Ethnicity or Nationality	7	2.32
Two or More	7	2.32
Undeclared	13	4.31
White	61	20.20
First-Generation Status		
Continuing Generation	38	12.63
First-Generation	263	87.37
Social Class		
Middle Class or Wealthy	113	37.54
Low-income, Working Class, Poor	182	60.46
Unknown	6	1.99

Note. "Undeclared or Unknown" students include 6 responses declining to share ("prefer not to answer," "NA") and 3 responses for which a preferred gender could not be intuited ("Caucasian," "Mexican").

Table 4.2

Student Traits Frequencies: Academic Traits

N = 301 students	N	Percent
Major Type		
Business and Tech	66	21.93
Education	165	54.82
Social and Behavioral	70	23.26
Modality		
Combination of modalities	57	18.93
In-person	56	18.60
Online only (asynchronous)	180	59.80
Virtual Campus (Zoom, synchronous)	8	2.66
Student Type		
NLU Native (All)	144	47.84
NLU Native (1st term)	36	11.96
NLU Native (Continuing)	108	35.88
Transfer (All)	157	52.16
Transfer (1st term)	39	12.96
Transfer (Continuing)	118	39.20
First Term (All)	75	24.92
Continuing (All)	226	75.08

Table 4.3

Student Traits Frequencies: Non-academic Labor Traits

N = 301 students	N	Percent
Caregiving		
Caregiving (Any)	187	62.13
Caregiving (Primary)	136	45.18
Caregiving (Occasional)	51	16.94
No Caregiving	115	38.21
Weekly Paid Employment Hours		
0	49	16.28
1-10	30	9.97
11-20	38	12.63
21-30	43	14.29
31+	141	46.84

Note. Caregiving allowed for more than one response therefore totals exceed 100%.

combining NLU native (first term) and transfer (first term). Students taking courses online only made up 59.8% of the respondents, followed by any combination of modalities (18.9%) and in-person (18.6%). Only 2.7% of students were taking courses through the Virtual Campus (synchronous Zoom) modality. This number (n = 8) was too small for the data analysis and was excluded. Self-reported program majors were coded into major types: Business and Technology, Education, and Social and Behavioral Sciences. The major types match the institutional organization of many aspects of the academic advising and student success coaching support models. Education majors were the majority with 54.8% of the participants, included Infant and Toddler Studies, Early Childhood Education, Elementary Education, Early Childhood and Elementary Education, Secondary Education (Math and English), and Applied Educational Studies. Next, Social and Behavioral Sciences majors included Criminal Justice and Criminology, Human Services, Interdisciplinary Studies, Psychology, and Social Work and comprised 23.7% of the sample. Finally, Business and Technology majors made up 21.9% of the students and included Business Administration, Business Management, Communication and Media Studies, Computer Science and Information Systems, and Marketing.

Non-Academic Labor: Caregiving and Weekly Employment. The two variables that captured non-academic work responsibilities, caregiving and weekly employment hours (work), show that the vast majority of the students hold substantial responsibilities outside of their academic responsibilities. Whereas 45.2% of students identified as primary caregivers (of their own child, sibling, parent, or other relative; "Caregiving (Primary)"), 17.3% cited occasional caregiving responsibilities of their own child, sibling, parent, or other relative. These were combined to create a "Caregiving (Any)" variable (62.1%). Students who responded with no caregiving responsibilities or with any type of caregiving free response related to employment,

such as “babysitting” and “nanny,” were coded as “No Caregiving.” The largest reported range of weekly paid employment was 31 hours or more, at 46.8%, followed by 16.3% reporting no hours, 12.6% reporting 11–20 hours, 14.3% reporting 21–30, and 9.9% reporting 1–10 hours.

Sense of Belonging

Sense of belonging was the dependent variable of interest. The Sense of Belonging Scale was adapted for the use of this survey, adding a third question about perceived respect specific to faculty (“How much respect do professors at NLU show toward you?”), for a total of seven questions. Each question was a 5-item Likert type scale (1 = strongly disagree, 5 = strongly agree). A belonging construct variable was created by calculating the average of the seven sense of belonging items for each respondent. Descriptive statistics (see Table 4.4) show the highest mean of 4.5 for respect staff with a standard deviation of .8. The connect staff item showed a mean of 3.8, one of the lowest values, with a relatively large standard deviation of 1.1, suggesting that students may feel respected by staff without also feeling a strong sense of connection to staff. The matter item included the lowest mean of 3.7 and largest standard deviation of 1.1. The mode was 5 for the welcome, respect student, respect staff, and respect prof items, indicating a high reported sense of welcome and feelings of respect across the population.

To determine the reliability of the sense of belonging items, unidimensional reliability analysis was conducted (see Table 4.6). Sense of belonging items had acceptable internal consistency ($\alpha = .881$).

Descriptive statistics, shown in Table 4.7, include a mean value of 4.1, median value of 4.3, and standard deviation of .73. The mode was 5, indicating a high reported sense of belonging across the population.

Table 4.4

Descriptive Statistics for Belonging Items

N = 301	Mode	Median	Mean	Std. Deviation
Welcome	5.0 [a]	5.0	4.4	0.8
Understand	4.0 [a]	4.0	3.9	1.0
ConnectStaff	4.0 [a]	4.0	3.8	1.1
RespectStu	5.0 [a]	5.0	4.3	0.8
RespectStaff	5.0 [a]	5.0	4.5	0.8
RespectProf	5.0 [a]	5.0	4.4	0.8
Matter	4.0 [a]	4.0	3.7	1.1

Note [a] The mode is computed assuming that variables are discreet.

Table 4.5

Frequencies for Sense of Belonging Items

	N	Percent
Welcome		
Very unwelcoming (1)	3	0.99
Slightly welcoming (2)	4	1.33
Somewhat welcoming (3)	40	13.29
Quite welcoming (4)	80	26.58
Very welcoming (5)	174	57.80
Missing	0	0.00
Total	301	100.00
Understand		
Do not understand at all (1)	6	1.99
Understand a little (4)	23	7.64
Somewhat understand (3)	64	21.26
Understand quite a bit (4)	107	35.55
Completely understand (5)	101	33.55
Missing	0	0.00
Total	301	100.00

	N	Percent
ConnectStaff		
Not at all connected (1)	12	3.99
Slightly connected (2)	34	11.29
Somewhat connected (3)	58	19.27
Quite connected (4)	102	33.89
Extremely connected (5)	95	31.56
Missing	0	0.00
Total	301	100.00
RespectStudents		
No respect at all (1)	2	0.66
A little bit of respect (2)	9	3.65
Some respect (3)	34	11.29
Quite a bit of respect (4)	101	33.56
A massive amount of respect (5)	155	51.49
Missing	0	0.00
Total	301	100.00
RespectStaff		
No respect at all (1)	3	0.99
A little bit of respect (2)	10	3.32
Some respect (3)	21	6.98
Quite a bit of respect (4)	81	26.91
A massive amount of respect (5)	186	61.79
Missing	0	0.00
Total	301	100.0
RespectProf		
No respect at all (1)	3	0.99
A little bit of respect (2)	8	2.66
Some respect (3)	19	6.31
Quite a bit of respect (4)	94	31.23
A massive amount of respect (5)	177	58.80
Missing	0	0.00
Total	301	100.00
Matter		
Do not matter at all (1)	16	5.32
Slightly matter (2)	26	8.64
Matter somewhat (3)	81	26.91
Matter quite a bit (4)	100	33.22
Matter a massive amount (5)	78	25.91
Missing	0	0.00
Total	301	100.00

Note The survey question for welcoming item is: How welcoming have you found NLU to be? The survey question for understand item is: How well do people at NLU understand you as a person? The survey question for connectstaff item is: How connected do you feel to staff at

NLU, i.e. Advisor, Coach, Student Affairs Staff, etc.? The survey question for respectstudent is: How much respect do NLU students show toward you? The survey question for respectstaff is: How much respect do NLU staff (Advisor, Coach, Student Finance Rep, etc.) show toward you? The survey question for respectprof is: How much respect do NLU professors show toward you? The survey question for Matter is: How much do you matter to others at NLU?

Table 4.6

Frequentist Scale Reliability Statistics for Belonging Items

Estimate	Cronbach's α
Point estimate	0.881
95% CI lower bound	0.859
95% CI upper bound	0.901

Table 4.7

Descriptive Statistics of Independent Variable

	Belonging Construct
N	301
Missing	0
Mode	5.000[a]
Median	4.280
Mean	4.135
Std. Deviation	0.726
Minimum	1.570
Maximum	5.000

Note [a] The mode is computed assuming that variables are discreet.

Table 4.8

Descriptive Statistics for Dependent Variables

ANOVA - Belonging

Cases	Sum of Squares	df	Mean Square	F	p
RaceEthnicity	4.129	6	0.688	1.166	0.325
Residuals	173.575	294	0.590		

Note. Type III Sum of Squares

Post Hoc Comparisons - RaceEthnicity

		Mean Difference	SE	t	p_{tukey}
Asian or Asian American	Black or African American	-0.053	0.186	-0.286	1.000
	Hispanic	-0.094	0.184	-0.514	0.999
	(Other	-0.313	0.319	-0.981	0.958
	Two or more races	-0.067	0.335	-0.200	1.000
	Undeclared	0.450	0.278	1.618	0.671
	White	0.033	0.197	0.167	1.000
Black or African American	Hispanic	-0.041	0.109	-0.378	1.000
	(Other	-0.260	0.283	-0.918	0.969
	Two or more races	-0.014	0.301	-0.047	1.000
	Undeclared	0.503	0.236	2.134	0.335
	White	0.086	0.131	0.659	0.995
Hispanic	(Other	-0.219	0.282	-0.776	0.987
	Two or more races	0.027	0.300	0.091	1.000
	Undeclared	0.544	0.234	2.325	0.236
	White	0.127	0.128	0.997	0.954
(Other	Ethnicity or Nationality)	0.246	0.398	0.618	0.996
	Ethnicity or Nationality)	0.763	0.351	2.175	0.312
	Ethnicity or Nationality)	0.346	0.291	1.190	0.898
Two or more races	Undeclared	0.517	0.365	1.415	0.794
	White	0.100	0.308	0.325	1.000
Undeclared	White	-0.417	0.245	-1.703	0.615

Note. P-value adjusted for comparing a family of 7

Campus Climate. Because of the role campus climate has been demonstrated to play in sense of belonging for Students of Color, unidimensional reliability analysis was conducted to see if the seven campus climate items held internal consistency for further analysis on the independent variables in an effort to understand sense of belonging more fully. Campus climate items did not have acceptable internal consistency ($\alpha = .571$). Further, analysis of variance (ANOVA) was conducted on each campus climate variable with gender and race and ethnicity as independent variables (see Table 4.8). These variables were used due to the literature showing that Black women and men students have been shown to choose Hispanic-Serving Institutions (HSI) due to their diversity and proximity to home, yet can experience HSIs as both hostile and welcoming (Brooms, 2023; Vega, 2022; Willis et al., 2019). No statistical significance was found among the variables, although this does not rule out different perceptions of campus racial climate. Use of a reliable survey instrument or perhaps a different research methodology may be required to capture any differences in perceptions of campus climate in this heterogeneous campus population (Cuellar & Johson-Ahorlu, 2016).

Ed Tech Use

Three EdTech use variables were created to capture engagement, one each for D2L, Navigate Student, and Eagle Life. To conduct linear regression, reported use rates were recoded to scaled variables based on high (daily/weekly = 2), medium (monthly/quarterly = 2), and low (annually/never = 0). Frequencies are described in Table 4.9 and indicate distinct use across each tool. Unsurprisingly, the learning management system tool, D2L, had the highest use rates with close to 100% of students using the web or mobile app daily or weekly. Lower use rates could be related to the type of coursework in which a student is enrolled; for instance, although D2L is universally required for all courses, fieldwork and internship courses rely more heavily on

Table 4.9

Frequencies for Ed Tech Tool Use

N = 301 responses	N	Percent
D2L Use		
Low (Never, Annually)	1	0.33
Medium (Quarterly, Monthly)	6	1.99
High (Weekly, Daily)	294	97.67
Missing	0	0.00
Navigate Student Use		
Low (Never, Annually)	25	8.31
Medium (Quarterly, Monthly)	74	24.58
High (Weekly, Daily)	202	67.11
Missing	0	0.00
Eagle Life Use		
Low (Never, Annually)	94	31.23
Medium (Quarterly, Monthly)	112	37.21
High (Weekly, Daily)	95	31.56
Missing	0	0.00

learning experiences and engagement outside of the D2L course shell. Additionally, course content and learning activities are designed to fit the modality, therefore engagement in an online course may look different than the same course taught face-to-face.

Slightly more than two thirds (67.1%) of students reported using Navigate Student daily or weekly, while 8.3% reported low use rates, and 24.6% reported medium use. These use rates are not surprising, as the tool's most commonly reported use reasons, described in greater detail in a later section, were to view the class schedule and to schedule appointments, both tasks a student may not do frequently. The third tool, Eagle Life, showed nearly equal use rates across low, medium, and high, with respective use rates of 31.2%, 37.2%, and 31.6%.

Regression Analysis Results

Linear regression models were used to test the relationship between student engagement with EdTech and reported sense of belonging and to identify moderating student traits. Any independent variable showing a positive or negative coefficient relationship with belonging with a p-value <.05 was considered significant. A total of 24 predictor variables were included; following standard best practices of having at least 10 data points per predictor (Goss-Sampson, 2020), the sample size of 301 provided sufficient data to handle the size of the model.

In order to determine if EdTech engagement predicted belonging, linear regression was performed. Linear regression models were run with sense of belonging as the dependent variable and D2L use, Navigate use, and Eagle Life use as the covariates. To test student traits as moderating variables on the relationships between EdTech use and reported sense of belonging, the following student traits were recoded to binary variables: first-generation, poor/working class/low-income, gender (male, female, non-binary, undisclosed), race and ethnicity (Black or African American, Asian, Hispanic/Latiné, White, American Indian or Alaska Native, two or

more races, other ethnicity or nationality, and undisclosed race), generation (Gen Z, Millennial, Gen X, or Boomer), transfer, caregiver (primary, caregiver (any), none), course modality (online, in-person, Virtual Campus, combo), and major band (Business and Tech, Education, Social and Behavioral Sciences). The binary variables were used as factors in the multiple linear regression model.

Multiple Linear Regression Model 1. Multiple Linear Regression Model 1 was run to explain all Ed Tech use variables (D2L, Navigate Student, and Eagle Life) and moderating student trait variables gender, race and ethnicity, age (generation), first-generation status, social class, major type, course modality, student type (transfer or NLU native and first-term or continuing term), caregiving responsibilities, and weekly employment on the dependent variable belonging construct. R^2 for the overall model was 19.7% with an adjusted R^2 of 12.4%, a small effect size.

Social class, transfer/NLU native student type, and caregiving responsibilities statistically significantly predicted Ed Tech tool use and belonging, ANOVA $F(25, 275) = 2.705$, $p < .001$.

Multiple Linear Regression Model 2. Multiple Linear Regression Model 2 was run to explain D2L use and moderating student trait variables gender, race and ethnicity, age (generation), first-generation status, social class, major type, course modality, student type (transfer or NLU native and first-term or continuing term), caregiving responsibilities, and weekly employment on the dependent variable belonging construct. R^2 for the overall model was 18.2% with an adjusted R^2 of 11.4%, a small effect size.

Social class, transfer/NLU native student type, and caregiving responsibilities statistically significantly predicted Ed Tech tool use and belonging, ANOVA $F(23, 277) = 2.674$, $p < .001$.

Multiple Linear Regression Model 3. Multiple Linear Regression Model 3 was run to explain Navigate Student use and moderating student trait variables gender, race and ethnicity, age (generation), first-generation status, social class, major type, course modality, student type (transfer or NLU native and first-term or continuing term), caregiving responsibilities, and weekly employment on the dependent variable belonging construct. R^2 for the overall model was 17.5% with an adjusted R^2 of 10.7%, a small effect size.

Social class, transfer/NLU native student type, and caregiving responsibilities statistically significantly predicted Ed Tech tool use and belonging, ANOVA $F(23, 277) = 2.556$, $p < .001$.

Multiple Linear Regression Model 4. Multiple Linear Regression Model 4 was run to explain Eagle Life Use and moderating student trait variables gender, race and ethnicity, age (generation), first-generation status, social class, major type, course modality, student type (transfer or NLU native and first-term or continuing term), caregiving responsibilities, and weekly employment on the dependent variable belonging construct. R^2 for the overall model was 18.8% with an adjusted R^2 of 12.0%, a small effect size.

Social class, transfer/NLU native student type, and caregiving responsibilities statistically significantly predicted Ed Tech tool use and belonging, ANOVA $F(23, 277) = 2.786$, $p < .001$.

Table 4.10

Linear Regressions: Belonging Construct and Ed Tech Use with Student Traits (N = 301)

	1	2	3	4
	β	*β*	*β*	*β*
D2L Use	0.420	0.341		
Navigate Use	-0.019		0.073	
Eagle Life Use	0.154			0.139
Female	0.164	0.120	0.142	0.186
Asian or Asian American	0.405	0.229	0.202	0.362
Black or African American	0.480	0.347	0.342	0.467
Hispanic or Latiné	0.467	0.329	0.332	0.463
Two or More Races/Ethnicities	0.482	0.329	0.334	0.474
White	0.420	0.270	0.280	0.418
Other Ethnicity or Nationality	0.863	0.639	0.557	0.756
Boomer	-0.046	-0.057	-0.062	-0.043
Gen Z	-0.102	0.144	0.118	-0.094
First Generation	0.108	0.077	0.060	0.084
Poor, Working Class, Low-income	-0.303**	-0.327**	-0.328**	-0.300**
Education	-0.001	0.030	0.013	-0.019
Social and Behavioral Sciences	0.002	0.018	0.010	-0.012
Combo Modality	0.029	0.029	0.007	-1.157×10^{-4}
In-person Only Modality	0.040	0.039	0.024	0.018

	1	2	3	4
	β	*β*	*β*	*β*
Online Only Modality	0.177	0.183	0.176	0.163
Transfer	-0.266*	-0.285*	-0.280*	-0.271*
First Term	0.134	0.109	0.107	0.134
Caregiving (Primary)	0.098	0.098	0.109	0.106
Caregiving (Any)	-0.309*	-0.299*	-0.297*	-0.305*
Employed 30+	0.097	0.108	0.095	0.095
Adjusted R^2	0.124	0.114	0.107	0.120

Note Significance levels: *p<.05, **p<.001

Qualitative Analysis Results

The survey collected feedback through two types of open-ended questions. The first was a series of "other" comment fields on the questions about why or why not students used the EdTech apps: Do you use the [D2L/Navigate Student/Pulse (D2L)] app? If yes, provide the reasons for use. If no, provide the reasons you do not use the app. Common reasons were provided along with a blank "other" option. These use reasons were categorized by use reason type (view class schedule, contact professor, schedule appointments, etc.) and organized by student traits, focusing on social class, transfer/NLU native, and caregiver in order to identify commonalities and distinctions across the general sample population and the traits that were found to be statistically significant in the linear regression models. The second way feedback was collected was through the following open-ended survey questions inviting any comments on a series of prompts:

- Please share any comments about how you feel welcome at, connected to, or respected at NLU.
- Please share any comments about your use of D2L, Navigate, or Eagle Life and feeling connected to NLU, staff and professors, or NLU students.
- Please share any other comments about your experience at NLU or use of NLU technology.

Initial coding of this data started with noting "first impressions" of what the participant said (Saldaña, 2013) per each of the three questions. The overall first impression of the data was an affective quality: positive, negative, and neutral. Each comment was coded as positive, negative, mixed, (containing both positive and negative) or neutral. The next step involved a review the frequency of the themes based on the three student traits of student type (transfer or NLU

native), caregiving (any or none), and social class (low income/working class/poor or middle class/wealthy/unknown) and noting any patterns of themes by trait. In reviewing the data in its entirety rather than by question, and with the initial coding, it became clear that simultaneous coding was needed to capture more of the complexity in some of the responses, as well as to avoid projecting an overall meaning where one may not have been intended. Several parent codes emerged, three of which echoed the research question and framework guiding the survey design: belonging, technology, and traits. Within the parent codes of belonging, technology, and experience the affective themes emerged. In this way, the affective themes were contextualized and created opportunity for more nuance without assigning a global meaning or value to comments. The codebook (see Appendix C) includes significant phrases from the participants, both for the themes as well as the guidance for using each theme (Creswell & Poth, 2018). To test the first draft of the codebook for validity, inter-rater reliability was completed. A random selection of 10% (22) of the comments were coded by a second rater from the Undergraduate College with expertise of the student population and research question and design. The initial percent agreement between raters was calculated at 77.2%, below the desired 90% rate. In discussion of the divergences, typos were discovered in the codebook and upon correction there was a slightly higher agreement. Other divergences related to the belonging and experience sub-codes for affect, belonging\positive, belonging\negative, belonging\neutral, and experience\positive. A review and discussion of the codes and instructions ensued which included a review of the survey questions to which the comments were made. The use instructions were refined to better align to the questions and incorporate more significant phrases from participants. With this refinement inter-rater reliability reached 91.2% agreement.

Reasons for EdTech App Use

A thematic analysis of the use reasons for students who reported using any of the three EdTech tools (D2L, Navigate Student, and Eagle Life) involved identifying the frequency of each theme for the entire sample, and then the student traits of student type (transfer or NLU native), social class (middle class/wealthy/unknown or low income/working class/poor, LIWCP), and caregiver (primary/occasional (any) or none). The use themes were common across all populations and all EdTech tools, with slight variations in frequency or in the order of most common themes.

Navigate Student. The Navigate Student app was the most frequently used mobile app of the three EdTech tools, with 234 respondents (77.7%) reporting using the app. Caregivers used the app at a rate of 75.6%, transfer students at a rate of 70.7%, and LIWCP students at a rate of 78.5%. The top three themes for use were view class schedule, schedule appointments, and view holds. This order held true for the overall sample, caregivers, and LIWCP students, while the top use theme for transfers was schedule appointments, followed by view holds, then view class schedule.

The top two themes for not using the app were consistent across the sample: Wasn't aware (43.3%) and use desktop app (38.8%); however, there were differences by student trait. Transfer and LIWCP students had high rates of not being aware of the app, at 47.8% and 46.15%, respectively, compared to 40.0% of caregivers. Conversely, caregivers had the highest rate of use desktop app theme (48.9%), followed by 39.1% of transfers and 33.3% of LIWCP students.

D2L. The D2L app was the second most frequently used mobile app of the three EdTech tools, with just over half of the respondents reporting using the app (50.2%). LIWCP students

reported the highest app use (48.9%), followed by caregivers reporting app use of 42.7%, and transfers used the app at a rate of 41.7%. The top three themes for use were complete assignments, view class schedule, and contact professor. The order of the top two themes varied by student trait and contact professor was third across all groups. The top theme for caregivers and transfers was view class schedule, with the second theme being complete assignments. The top two themes of view class schedule and complete assignment were reported with equal frequency for LIWCP students (78.7%).

The top themes for not using the app across the sample (n = 150) and for each trait was use web version. The theme other–tech issue emerged for three students expressing they had trouble logging on or were unsuccessful downloading the app. Tech issues were not reported for the Navigate Student app but was a theme for the Eagle Life app. All three were caregiver and LIWCP students and one also identified as a transfer student.

Eagle Life. Use of the Eagle Life app ranked third among the EdTech apps (n = 65, 21.6%). The top three use themes were consistent across the sample and all student traits: first, view NLU resources; second, sign up for events; and third, sign up for clubs and organizations. Use rates were highest among LIWCP students (58.5%), followed by caregivers (49.2%), and then transfer students (44.6%).

The top theme for not using the Eagle Life app, wasn't aware, occurred more than twice as often as the total number of students who reportedly used the app (n = 141, 46.8%). A preference for desktop/web app use was cited twice. As with the D2L app, there were notable other themes reported. These included other–tech issue ("couldn't find it on Google Play," "cannot sign in," and "The app doesn't work for my current version of Android"); other–no

interest (“no time” and “don’t feel like it”); and other–perceived user (“I’m not attending in-person”).

Please Share Any Comments: Themes on Belonging, Tech Connection, and Tech Use

The series of three open feedback questions produced 228 substantial comments, excluding all forms of “no comment” from 115 participants. The four major findings are organized thematically and will be described further in the following sections: Traits Frame the Experience; Gratitude; Service; and Desired Improvements.

Traits Frame the Experience: “I am online. But I always feel respected.” Across all three questions participants shared traits as a way to frame their experience. Online students in particular explicitly mentioned that they were online. Some, like the student who shared the header quote, did so in a way that suggested online students viewed themselves as being separate from the in-person community about which the survey asked. One participant, in response to the first open question, shared, “I’m an online student. I don’t really think I should be commenting on things that happen in person.” Another made a similar distinction while also speaking to the online sense of community she felt: “I am an online student so I can’t speak for the campus, but the online community and the professors are all welcoming.” Some online students went further and expressed a lack of connection to the institution, a desire for greater connection and involvement, and in one case, feelings of exclusion. They said, “I’m strictly an online student and work full-time in the morning which is during school events…I do feel excluded from connecting with other students. I would appreciate it if each event had a Zoom invitation.” The intersectionality of being an online student and working adult or adult learner came up in other comments. As one student shared, “I am returning to school after [some time] away. Being on-line and working, I am not that connected.” Another participant shared a similar sentiment with a

suggested solution: “I wish that some events are on weekends for people who do online classes [because] we work.” This demonstrates that there are some online students who desire more engagement and events as a way to connect with NLU.

For others, less access to the in-person resources and events produced disappointment in their experience. An online participant who was also a transfer student noted that they did not feel connected and went on to share, “I think transfer students are neglected from NLU activities and are not given resources.” On the other hand, there were participants who framed satisfaction with respect to their identities and technology use. One student wrote, “D2L is super easy to use and is very helpful to me as an adult student because I have a full-time job and a family.” In this way, a student’s positive experience with D2L holds importance because of their non-academic labor traits.

In one instance a participant expressed a desire to take all online classes as a result of their experience. Unlike other comments about identity, this participant does not explicitly share the identities or course modality which shape their experience:

> How I feel about NLU is terrible because I always feel like a [second-class] citizen and whenever I bring this up to a counselor or any other staff member they either say I'm just racist or narrow-minded. I wish [I would’ve] taken all of my classes online, so I don't have to live in such a toxic environment.

Here the participant expresses a desire to be removed from an experience in what is perceived as a toxic presumably physical campus environment. This was the only mention of a desire to take online classes and the use of the word toxic was the strongest language across all comments. Details that are missing from the comment are found in the survey responses: this participant identified as a transfer student, occasional caregiver, and LIWCP. Further, they are first-

generation, White, male, Gen Z, and take their courses in-person. There was one other participant who shared a comment with a similar tenor: “Feel like I’m being discriminated against for being a certain race.” The survey responses show that the student identified as a transfer student and LIWCP and while not a caregiver, they reported working full-time. They are first-generation, White, male, Gen Z, and take their courses in-person.

Gratitude: “Thank you National Louis University for believing in me.” This theme captured various expressions of gratitude broadly to the institution and in some cases specific appreciation of people or groups of people. One comment was from a student who responded to all three questions and they said, “NLU made me feel like I could finish school in spite of my debilitating condition.” It appears that the sentiment carried enthusiasm; out of their three responses it was the only one using all capitalized letters. Other participants shared gratitude for the opportunity, and still others perceived NLU as uniquely able to provide a context for their success. One participant commented, “Frankly, I believe no other school would have made me feel welcomed at, connected to, or respected at like NLU. Nearly all students, teachers, and staff members I’ve gotten a chance to know has had a sweet influence on me.” Another student used the word “empowered” to describe their experience. One transfer student commented on feeling welcome by “[Black Student Excellence in Education Narrative] and Black men groups.”

In addition to general gratitude to NLU, the option to take courses online was a specific source of gratitude in some comments. One student with caregiving and work responsibilities offered the following, “I am grateful for online classes as this allows me to fulfill my other commitments as a mom and my job.” This comment is another example of the ways in which students framed their experience by traits.

Service: "I feel welcome and engage because of the strong communications that I have." Many participants described interactions with faculty or staff in a way that spoke to connection, using words like "support" and "helpful." Further, the participant who shared the heading quote attributed feeling welcomed to the strong communication "between [my] professor, my student advisor, and even down to our peer specialist." They went on to express gratitude for helping "an old woman like me to master education and the online navigation process." Themes of traits and gratitude are seen here, as well. While comments were largely positive, there were also comments about poor service or unmet expectations. One student asked, "Why are there phone numbers on each syllabus if none of the professors are going to answer the phone?" There were other comments which described student-initiated outreach to staff or faculty by phone and email. Communication, availability, knowledge of services and policies, and helpfulness shaped the ways in which students spoke of their experiences, which are described further in the next section.

Specific Desired Improvements: "Please PLEASE put more cubbies on the 6th floor." Many students shared specific examples of interactions with NLU staff, faculty, and technology which shaped their experiences. Most referenced single incidents, although there were comments regarding a culmination of encounters, such as a student who shared, "Improve communication greatly. Many of the people I interacted with at the beginning did not call back." They provided details around their experience of waiting 19 days to receive a response to one of their questions. The same respondent also shared feedback on the D2L app, expressing a desire for improved functionality on a phone and tablet to make it easier to study "in between working" and when "out and about." Another participant shared a recurring challenge of uploading files in

D2L. And yet another described challenges in D2L with respect to how course engagement is structured among professors and students:

> Professors sometimes take a week to respond. And that's after a follow up. Discussions on D2L requires students to have expressive writing skills. Students don't reply or check their post after it's done. Are there other ways? Like an optional zoom discussion session.

This participant describes the ways in which the low faculty and student engagement in the learning management system shapes their engagement. Other mentions of specific desired improvements related to student identity. The participant who felt excluded because of their online status is one example, as they offered, "I would appreciate it if each event had a Zoom invitation." And another student shared the following:

> Especially with students who have ADA accommodations, [some professors] don't care about your needs. Please come up with some kind of check and balance. Professors who go the extra mile for their students should be recognized. And the ones that students have a hard time with will spoil it for everyone. The end of term survey needs to be [updated] and simplified.

This longer quote captures experiences with multiple faculty over time related to their having a disability. Another specific suggestion related to a student's identity came from a participant who commented, "I wish I had more guidance on being a [Deferred Action for Childhood Arrivals] recipient and managing school financing." There is a large undocumented student population at the institution. Conversely, another student shared, "As an undocumented student I feel like there [are] a lot of resources and NLU has been a great experience thus far." The same participant shared in a separate comment, "Resources are helpful if you take the time to look at what they offer." Looking at these perspectives together suggests that resources for undocumented students

are another area where greater awareness is needed and it is easier for some students to find resources than others.

Lastly, the quote in the section header, "Please PLEASE put more cubbies on the 6th floor," is a reference to the flagship downtown campus. The participant also said, "Hundreds of students [come] in-person daily. Please put more [cubbies] in the building so more students have a place to do their work in the comfort of those cubby things. Please don't just blow this response over, please make something happen." This comment in itself is a form of student engagement, an effort to improve their own and other students' experiences, and with this feedback the student is proposing a design in the planning of the physical space. This engagement in design was also seen in comments about technology, such as the participant who desired a better mobile experience for when they are "on the go." The plea at the end of the request for additional study space suggests that there is uncertainty regarding the comment being heard or acted on. While it is important to provide opportunities for feedback, institutions must be prepared to listen and to act upon what is shared for transparency with students (Suskie, 2014). The data analysis uncovered several key findings and implications for practice, both broadly in institutions of higher education and at NLU, which are discussed in Chapter 5.

Chapter 5: Discussion

Introduction and Significance of Study

Greater numbers of postsecondary students are experiencing substantial portions of their learning in technology-mediated spaces and higher education practitioners and faculty increasingly rely on educational technology (EdTech) to engage students in their academic and co-curricular experiences. Engagement is important to student connection, persistence, and eventual graduation, yet little is known about the ways in which EdTech tools impact learning and engagement, and the impact on sense of belonging in particular. Using a critical socioecological sense of belonging framework (Strayhorn, 2023), this mixed methods study offers insights into these relationships by asking the research questions:

- In what ways does student engagement with EdTech influence undergraduate student sense of belonging?
- What is the impact of student traits on the relationship between EdTech and sense of belonging?

There is a dearth of research on the experiences of new majority students at Minority-Serving Institutions, such as Hispanic-Serving Institutions (HSI), and private non-profit bachelor's granting access institutions. Extant research typically focuses on only in-person or only online learning environments and uses qualitative or quantitative methodologies. This study was conducted at National Louis University (NLU), a private non-profit, broad access HSI in the Midwest with a heterogeneous student population. The target population was large and diverse across traditional demographic traits, as well as traits which have been shown to impact college attendance and outcomes but which remain under-researched in the broader higher education literature, such as caregiving responsibilities and transfer status (Strayhorn, 2023; Torres &

Boeck, 2022; Ardoin, 2020). This study also included students attending classes in-person, online (asynchronous), and virtually (synchronous online). In exploring these research questions across a diverse population, there is an opportunity to learn which traits have predictive value on the relationship between EdTech engagement and reported sense of belonging through a linear regression model, as well as to understand in the words of students how they experience the EdTech tools and the institution.

The mixed methodology provided insights into important quantitative measures, such as a sense of belonging construct and EdTech tool use, while also gathering insights for greater understanding from a large sample. The convergent design allowed for parallel data collection. Additionally, this study expanded insights into sense of belonging of an under-researched institutional type with a diverse student population. In doing so, this study validated a survey instrument to measure sense of belonging, which can be used institutionally in the future. The next section presents a summary of findings, with quantitative and qualitative summaries, followed by a comparison or integration explaining convergences and divergences across the two methods (Creswell & Plano Clark, 2017).

Summary of Findings and Discussion

The seven-item sense of belonging instrument was found to be a reliable with a high Cronbach's alpha and was used as a belonging construct, the dependent variable. Analysis of Variance (ANOVA) of student traits and the belonging construct found that race and ethnicity were not significant, which was a surprising finding as research has shown that statistical racial and ethnic minority students at heterogeneous campuses can experience campuses in different ways (Brooms, 2023; Cuellar & Johnson-Ahorlu, 2016). The multiple linear regression models testing EdTech use and reported sense of belonging did not show a significant relationship,

however three student traits were statistically significant moderating variables in predicting EdTech use and sense of belonging: transfer status, social class, and caregiving responsibilities. Qualitative analyses surfaced themes related to student traits, gratitude, service, and desired improvements, adding nuance to the quantitative findings. Viewed collectively, these findings show dynamic interactions among student traits, institutional policy, practice, systems, and people, and external systems and lend support for using an ecological model (see Figure 3) to understand these relationships.

Finding: Student Traits Shape How Students Understand Belonging

Student traits shaped how students explained their experiences with technology and sense of belonging. Being an online learner was not statistically significant in quantitative analyses, yet it was found to be a salient trait to participants in the qualitative analysis. This finding is further explored with a focus on the quantitative and qualitative findings distinctly and comparatively.

Quantitative

Transfer status, social class, and caregiving responsibilities were found to be statistically significant predictors of EdTech use and sense of belonging according to the linear regression models. There were no statistically significant differences in reported sense of belonging by race and ethnicity. Similarly, race and ethnicity were not statistically significant predictors of EdTech use or sense of belonging using the linear regression models. Other student traits that were not statistically significant included course modality, age, gender, employment, or major.

Qualitative

In describing feeling welcome and connected to NLU, students commonly framed their responses by including traits. The most shared trait was being an online student. Other traits that were explicitly mentioned were work and family (caregiving) responsibilities, age, being a transfer student, being a degree completer (having spent time away from college before

returning), having a disability, and being undocumented. Online students also expressed not feeling connected to the physical campus. Some desired more opportunities to engage with the physical campus through events in the evenings or on weekends, whereas others expressed a desire for more engagement through events on Zoom.

Comparison or Integration

Although traits like modality did not have a statistically significantly relationship with belonging, being an online student emerged as a salient trait for online participants and their online status was frequently framed as a reason for lack of credibility to respond to questions about the student experience. This suggests that at least some online students have different mental constructs and language around how they make sense of their virtual campus experience. Some students reported primarily utilitarian reasons for using the EdTech tools (schedule an appointment, view class schedule, complete an assignment), and may approach their technology-mediated engagement through task orientation rather than relationship orientation, where a discussion board post and email are not viewed or experienced as opportunities for connection, but rather as opportunities to complete a task or to get information.

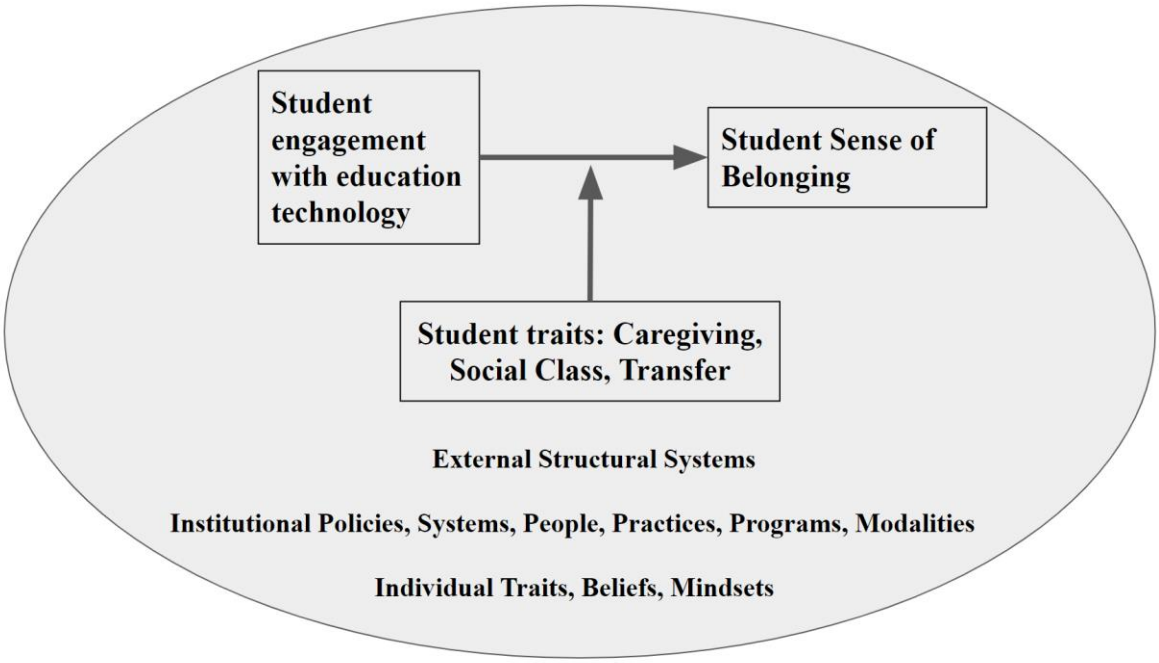
The ways in which students are introduced to the EdTech tools, as well as what a student sees while using the app, reflect the institutional practices, policies, and structures of how tools are vetted and configured and what information is provided to students during their onboarding experience and when. The participant who noted poor functionality of the mobile apps suggested a laptop program to solve the issue if the apps could not be improved. This comment shows an interplay of student traits (online learner, caregiver, employed), institutional policy and practice (app configuration, lack of laptop program), and external systems (histories which have shaped the policies and traits). Similarly, how faculty and staff engage with the tools is a reflection of policy and practice decisions, such as how faculty and staff are equipped to support students'

effective use of tools and their engagement with students in virtual spaces to stimulate connection and learning.

While there were no statistically significant differences in reported sense of belonging by race and ethnicity or by gender, the qualitative data lend support to the value of using mixed methodology to explore the complex ways in which students of different racial and ethnic identities perceive constructs like campus climate and belonging on campuses with heterogeneous student populations (Cuellar & Johnson-Ahorlu, 2016).

Figure 3

EdTech Engagement and Belonging Socioecological Model



Finding: Student Traits Influence EdTech Tool Engagement

Student traits were found to influence the reasons behind EdTech tool use. Transfer status, social class, and caregiving responsibilities were moderating variables for EdTech tool use and sense of belonging. This finding is further explored with a focus on the quantitative and qualitative findings distinctly and comparatively.

Quantitative

There were no significant differences found in use rates of EdTech tools by student traits. Transfer status, social class, and caregiving responsibilities were found to be statistically significant predictors of EdTech use and sense of belonging according to the linear regression models. Other student traits, such as race and ethnicity, program major, course modality, first-generation status, age, gender, or employment, were not statistically significant.

Qualitative

In describing use reasons for EdTech tools and explaining experiences with technology, students commonly framed their responses by disclosing traits, most often being an online learner. Other common traits included work and family responsibilities, age, being a transfer student, and having a disability or health condition. The theme of gratitude emerged from parenting and working students who expressed appreciation for the opportunity to complete their education online while maintaining other responsibilities.

Sharing traits contextualized expectations and experiences. For transfers and caregivers, a primary reason cited for not using the mobile D2L and Navigate Student apps was a preference for using the desktop version of the app, whereas across all populations, the primary reason for not using the Eagle Life mobile app was lack of awareness or technology issues, such as issues logging in. Across the three EdTech tools, the Eagle Life app had the lowest use rates and was infrequently mentioned in comments. For example, a transfer student described only the D2L

and Navigate apps as “necessary tools to continue my studies” and that the apps “make me feel connected to professors and other students.” Some participants expressed lack of interest in using the Eagle Life app, and still others expressed an intent to use the app upon becoming aware of it through completing the survey.

Comparison or Integration

With an intended purpose of facilitating engagement in student organizations, a type of engagement that leads to group membership rather than merely participatory engagement (Hurtado & Carter, 1997), the Eagle Life app is unique among the tools studied. The underutilization of the tool can be understood both institutionally and individually. At the institutional level, policies and practices may not promote the tool in a way that is effectively reaching students. The technology issues reported could indicate an opportunity to improve institutional practices, such as how the app is branded–called Eagle Life on campus and Modern Campus Involve in the app store–so that students can more easily find it for download. Equally, EdTech companies might consider ease of institutional branding of their product. Reported tech issues could also present at the intersection of structural systems, institutional, and personal reasons; for instance, if an app requires a particular version of an operating system and a student does not have a new enough phone or tablet to run that OS, they would either need to upgrade their device or miss out on the benefits of the EdTech tool and the corresponding engagement the tool is designed to enable. Here a greater reliance on technology to deliver engagement opportunities can cause a tech divide and perpetuate a history of inequitable access to technology (Kuh & Vesper, 2001).

Finding: Caregiving Predicts Relationship Between Student EdTech Use and Reported Sense of Belonging

Caregiving was a statistically significant moderating variable of EdTech use and reported belonging and emerged in the qualitative feedback. This finding is further explored with a focus on the quantitative and qualitative findings distinctly and comparatively.

Quantitative

In all multiple linear regression models, the caregiving (any) variable statistically significantly predicted EdTech use and belonging for all EdTech tools. For each model a negative beta coefficient (-.0299 for D2L, -0.297 for Navigate, and -0.305 for Eagle Life) showed less use of the tools predicted a lower reported belonging.

Qualitative

Caregiving most often appeared in comments by references to family or a role, such as being a mother. Naming caregiving responsibilities contextualized gratitude for the opportunity to go to school, appreciation for ease of use of technology, desire for improvements of technology, reasons for being unable to participate in events as scheduled, and reasons for not being interested in more engagement or app use. Caregivers who identified as such in the comments often also noted work responsibilities or being online students. Additionally, caregivers commented on the amount of work with respect to their roles, one student saying there was too much reading “for a working person with a family.” Of the 79 participants who shared qualitative feedback and identified as a primary or occasional caregiver, 59 also identified as low-income, working-class, or poor (LIWCP) and 20 as middle class, wealthy or unknown, and 40 were NLU natives and 39 were transfer students. Among all comments, caregivers who were also NLU natives stood out for having a low incidence of negative affective themes regarding belonging and experiences.

Comparison or Integration

When occasional and primary caregiving responsibilities are considered together, a picture emerges of a spectrum of experiences of students who reported caregiving responsibilities of their own children, older relatives (parents, grandparents), and younger relatives (siblings, cousins). These roles and responsibilities are internal student traits, but also reflect externalities, such as gendered role expectations, cultural norms around multi-generational households, and navigational and social capital tied to a student's social class and first-generation identity. Having additional insights into the type and consistency of caregiving roles may be necessary to understand the intersection of identities related to using technology and feeling a sense of belonging. For instance, caregivers who are transfer students have a point of comparison that NLU natives do not and therefore may be positioned to provide constructive feedback and to judge an experience. The more positive comments from NLU native caregivers invites questions around whether there are meaningful differences in the onboarding, support services, and resources offered to NLU natives as compared to transfer students. Transfer status is the focus of the next finding.

Finding: Transfer Status Predicts Relationship Between Student EdTech Use and Reported Sense of Belonging

Transfer student type was a statistically significant moderating variable of EdTech use and reported belonging and emerged in the qualitative feedback. This finding is further explored with a focus on the quantitative and qualitative findings distinctly and comparatively.

Quantitative

In all multiple linear regression models, the transfer variable statistically significantly predicted EdTech use and belonging for all EdTech tools. For each model a negative beta

coefficient (-.0285 for D2L, -0.280 for Navigate, and -0.271 for Eagle Life) showed less use of the tools predicted a lower reported belonging.

Qualitative

The theme of gratitude was prominent among transfer students' comments. Transfer students provided specific examples of interactions with staff and faculty, at times sharing names of staff with whom they had memorable positive interactions, particularly when there was strong and timely communication. Conversely, specific examples of negative experiences were shared as well, often related to unmet expectations and unclear, slow, or late communication, or challenges and effort required to reach a staff or faculty member. Comments generally had a positive affective quality.

Transfer students who were also attending online shared sentiments of not feeling connected due to being an online student, or expressed that they were not able to speak to the campus climate. The intersectionality of being an online learner and holding a job surfaced as a reason cited for not being able to participate in events that were scheduled on-campus or during the day. As noted in the prior section, some transfer students provided comparative feedback, including experiences with technology. One student mentioned that D2L was easier to navigate than the learning management system at another school.

Comparison or Integration

Experiences across the institutional ecosystem (policies, practices, people, systems, modalities) were all evident in the comments from transfer students and this population may be particularly sensitive to ease of use of technology and level of service in shaping their use of EdTech tools, as well as their sense of belonging institutionally. Transfer students bring the comparison point of having experienced another institution's policies, practices, people, and systems. Having a comparative vantage point could explain their ability to name exemplary or

poor service, a welcoming campus, or easy-to-use technology. Students who may have had a positive experience with respect to technology, people, policies, and campus environment elsewhere may be able to identify gaps in service or unmet expectations. As well, transfer students bring with them different navigational capital of university jargon, offices, and policies based on their experience which inculcates a resourcefulness and adeptness at finding information. When information is not easily found or when transfer students have exhausted on-demand information, they will desire timely and helpful service.

For transfer students who are also working or caregivers, time is a premium. A student who has set aside limited time to complete a task will expect helpful and timely service and support when they reach out. One participant, a transfer, caregiver, LIWCP student, expressed feeling "extremely disappointed" and felt like they were being treated as a number as a result of unmet expectations, slow communication, and an unhelpful advisor. Many of these students are also enrolled online and frustration or disappointment are typical indicators of disengagement in the literature of online student belonging (Henrie et al., 2015), and Peacock et al. (2020) found students who did not report a sense of belonging expressed feelings of disappointment.

Finding: Social Class Predicts Student EdTech Use and Reported Sense of Belonging

Social class was a statistically significant moderating variable of EdTech use and reported belonging and emerged in subtle ways in the qualitative feedback. This finding is further explored with a focus on the quantitative and qualitative findings distinctly and comparatively.

Quantitative

In all multiple linear regression models, the low income/working class/poor (LIWCP) variable statistically significantly predicted EdTech use and belonging for all EdTech tools. For

each model a negative beta coefficient (-.0327 for D2L, -0.328 for Navigate, and -0.300 for Eagle Life) showed less use of the tools predicted a lower reported belonging.

Qualitative

In the comments, there was a general absence of students directly identifying as low income, working class, or poor, with a few exceptions. One participant shared experiencing "financial instability" and being unaware of the financial aid process. Another desired "more guidance on being a [Deferred Action for Childhood Arrivals] recipient and managing school financing." Both of these students identified as LIWCP in the survey but not in their comments. A third participant identified as being homeless and was "thankful for the Food Pantry and the people associated with it." Meeting basic needs is a barrier to engagement for LIWCP students (Ardoin, 2020), and with respect to this study, the participant also noted, "Not sure what the Eagle Life app is, so I don't use it, too busy trying to complete assignments." The student's expressed lack of interest in an app is not a sign of disengagement, though. Taken together, these comments show that the student is engaged academically and with campus resources, but perhaps uninterested in technology that is not perceived to directly support their academic goals.

There was one mention of "financial strain" from a student identified as middle class or wealthy in the survey data. They described an "excessive cost per quarter hour" and what was described as overlap in content across courses, a "waste of time and money," as they neared the end of their degree. There was no mention of tuition from LIWCP students, although the previously mentioned participant who said they felt like a number also said of the University, "They only care about getting their money." Another, a transfer LIWCP student, was not aware that a summer class was not covered by financial aid but persisted despite the "bad first start."

Comparison or Integration

Social class was not a common identifier in the qualitative data. This is not unsurprising as talk of money, income, and class are generally taboo in the United States. Institutions of higher education tend to be elitist and classist and low-income students face pressure to perform to these class standards (Ardoin, 2020). For some LIWCP students social class identity was hinted at by comments, such as those whose onboarding lacked sufficient information regarding financial support. Providing clear and early information about resources, deadlines, and financing options is important for this student demographic in particular based on the student comments.

The student who suggested offering a laptop program as a solution to poor app functionality on mobile devices identified as LIWCP in the survey. It is unclear if the student owned a laptop, though the use rates of each mobile app was highest among LIWCP students. As LIWCP students with work and caregiver responsibilities juggle competing responsibilities, the preference for mobile apps could also reflect the need for convenience in order to fit academic responsibilities into complex schedules. This does not necessarily mean that LIWCP students do not have access to a laptop, but it is worth exploring the higher mobile use rates in order to address any technology gaps. Further, there appears to be a need for more explicit information shared with students about which EdTech tools are optimized on different devices, as well as to offer details on the tasks that can be completed through a mobile app versus desktop app.

Implications for Practice

The findings of this study influence suggested implications for practice, which include student-centered services, policies, and practice; student onboarding; and student perspective. These are expanded upon in the following sections.

Student-centered Services, Policies, and Practices

Use of EdTech tools, and of technology more broadly, should be approached with an end goal of increased student engagement and stronger learning outcomes. This study demonstrated that while there is not a significant relationship between EdTech use and reported belonging, there is a moderating relationship for transfer, low-income, working-class, and poor, and caregiving students. As these are historically minoritized and underrepresented students in postsecondary spaces, it should matter to institutions that students with these identities are served well in order to narrow enduring performance gaps. The effectiveness of technology should be evaluated against each tool's ability to achieve these goals (Heiberger & Harper, 2008). Too often the burden to engage and even to master technology falls on students. Returning to part of the definition of engagement offered by Quaye, Harper, and Pendakur (2020), engagement is "how an institution deploys its resources and organizes the curriculum, other learning opportunities, and support services to induce students to participate in activities that lead to the experiences and desired outcomes such as persistence, satisfaction, learning, and graduation" (p. 3). Just as great care is given to the design of a physical space, from wayfinding to the feel, in addition to serving a purpose, institutional leaders, student services staff, and EdTech companies all share a responsibility to design virtual spaces in a way that fosters engagement and promotes belonging, while also serving a purpose. Fundamentally, the tools must work well and serve a clear purpose that aids students in their educational pursuits. Collectively, institutions and EdTech companies must be involved in contributing toward deploying resources in a way that achieves this goal. Technology designed to serve students well is of particular importance to students who come from communities with long histories of marginalization and disinvestment.

Communication, availability, knowledge of services and policies, and helpfulness shaped the ways in which students spoke of their experiences with professors and staff. It is incumbent on higher education professionals to ensure critical information is provided to students, such as cost and financing options, without their asking. Failing to provide clear, timely, and helpful information to students throughout the academic journey can introduce frustration, placing a student at higher risk of disconnection and lack of belonging, and therefore greater risk of poor academic outcomes. On-demand content benefits flexible access and convenience, yet all student-facing staff and faculty should be trained to have basic knowledge regarding resources, services, and policies.

Due to the higher attrition risk of new students, staff and faculty who engage with new students should be cross-trained on functions that fall outside their direct responsibilities in order to best serve students. For instance, enrollment specialists, success coaches, and academic advisors all should understand financial deadlines and finance representatives should understand enrollment and academic deadlines. Faculty teaching courses with large first-term student enrollment should have increased knowledge of campus policies and resources, perhaps being compensated for the additional labor involved in supporting this population. All staff and faculty should know about the food pantry and student involvement opportunities. On campuses where a large share of students are first-generation, low-income, and caregivers, it is important to provide information to students without waiting for them to ask questions. Strategies include scheduling just-in-time synchronous check-ins with advisors and coaches, complemented by a cadence of nudges and information through text messages, emails, and announcements in the LMS. Some of these strategies can be enabled by configurations of the EdTech tools, which requires ongoing

training on and evaluation of the tools and staff to own the maintenance and to liaise with the EdTech companies.

Student Onboarding

In addition to training of staff and faculty, students must receive a strong onboarding experience around the software and technology required for full engagement and academic success. An engaging new student orientation, including a robust technology overview, situates students to have the confidence to approach their academic experience. As some students will experience cyberphobia (Ferdousi, 2023), support staff and faculty should be prepared to provide the necessary support to assuage anxiety. An effective technology overview would also include connecting students to the hardware needed to fully engage in the technology-mediated learning environment, such as acquiring a laptop or Wi-Fi hotspot.

Institutions committed to access may have rolling admission deadlines and therefore must grapple with the tension between flexibility and multiple intake cycles, and equipping students with tools and information to successfully navigate the institution. How can this be done well and quickly when some students will experience an abbreviated onboarding period between admission and the start of classes? Because not all students have the same needs and preferences, offering a variety of engagement opportunities, including on-demand and synchronous orientation programming and ongoing access to individual support, ensures that more students are supported in ways which match their needs and promote a successful academic transition.

Additionally, providing students with a checklist of the essential EdTech tools will facilitate their knowledge and awareness of the tools. Better branding of apps increases the likelihood that students will recognize the essential EdTech tools and be able to locate them in an app store, rather than having one name used institutionally for a web-based app and another

name used by the parent EdTech company in an app store. This is currently the case for the Eagle Life app, which is referred to as Eagle Life, Presence, Modern Campus Involve, and Modern Campus (Presence).

Student Perspective

Incorporating student perspective and feedback in the vetting, implementation, assessment, and configuration of technology, particularly with external vendors when large multi-year contracts are at stake, is another recommendation to improve student outcomes and technology use. Decisions about investments in technology must be user-centered, with an eye on serving diverse student populations to realize the promise of technology as an equalizer. For instance, technology working groups should include a student member who is compensated for their work. Ongoing efforts should be made to solicit feedback from students who may be less engaged in campus activities due to competing responsibilities, typically those from historically marginalized identities, as oftentimes students who are invited to speak on behalf of the student body are highly engaged and may be less representative of students on the institutional margins. Yet, as this study has shown, students are eager to share their opinions–completing the survey is arguably a type of engagement–and often offer solutions to some of the barriers to engagement or poor service they have experienced. One student shared varying experiences with faculty around ADA accommodations and suggested both recognizing professors who "go the extra mile" and updating and simplifying the end-of-term survey. This student also demonstrated a command of institutional resources and functioning in having taken the time to register for accommodations, an understanding that rewards and accountability can be systematized, and an awareness of the institutional end-of-term course survey, with thoughts on how to improve the

latter two. There is incredible value in centering this wisdom to shape institutional policy and practice.

To solicit broad perspectives there should be a regular cadence of administering the sense of belonging survey questions throughout the student lifecycle in a non-anonymous way to see change over time. To complement the quantitative data collection, a cycle of collecting qualitative data on sense of belonging, campus climate, and technology use would provide a depth of understanding of subpopulations of interest, such as students who are part of statistical minority populations, as well as students who have been historically overlooked in the research, such as caregiving students. Regularly collecting and evaluating data will ensure the institution is engaging in practices of continuous improvement (Suskie, 2014).

Recommendations for Future Research

This mixed methods study surfaced several areas for new and expanded research. First, as the scope of this research was on one institutional context and cannot be generalized, one recommendation for future research is to replicate these findings at other institutional types as well as other Minority-Serving Institutions, including Hispanic-Serving Institutions, to better understand the relationships of the variables under review. Mixed methods approaches and longitudinal studies will bring a depth of insight into these areas. As findings emerge, additional research is recommended on ways in which technology can be used to fill gaps in support and to connect students who are marginalized within the context of the campus. This may be particularly important for students who report feeling "othered." Second, this research showed the value of using a broad definition of caregiving responsibilities in understanding student engagement and belonging, as well as barriers to engagement. Additional inquiry into the experiences of parenting and caregiving students could provide insights into ways in which

technology can be leveraged to enhance the connectedness a student feels to the institution amidst busy non-academic responsibilities, which could benefit other students who carry competing responsibilities. More inquiry into the experiences of caregiving students would also shed light on the strategies students use to manage the changing nature of caregiving work, especially episodic caregiving, such as caring for a parent during a post-operative recovery period. Third, findings of this study suggest that online students perceive the online campus as distinct from the broader institutional environment and therefore efforts should be made to separate out the perceptions and experiences of online students and students who take traditional in-person courses. Relatedly, being an online student appeared to have salience as an identity for this student population and research could explain how this identity forms and the degree to which a collective online student identity exists as a foundation for creating affinity and population-specific engagement opportunities. Moreover, institutions with multiple campus branches like NLU should consider ways to understand campus climate distinctly at each location.

A final recommendation for future research relates to assessing the institutional use of EdTech tools. This study examined the use of three particular tools to explore types of engagement related to belongingness, yet many other institutional websites and software products are used throughout a student's lifecycle. What is the overall impact of technology utilization, from the perspective of the student as a user? How many systems are required for a student to benefit from the full learning experience? Is there a threshold after which point the number of tools reduces engagement and impedes student achievement? Particularly in light of the cost of technology and profits to be made in the EdTech industry, institutions of higher

education must be concerned with the effectiveness of each tool and also the culminating effect on students of using the system of tools which facilitate their learning.

Conclusion

While a large body of research exists on sense of belonging in education and engagement among undergraduate students, the research has disproportionately focused on the experiences of younger college-goers attending traditional face-to-face courses at Predominantly White Institutions, a college experience which reflects a decreasing share of postsecondary students. Research on the experiences of online students is also robust, yet a distinct area of research. The present study provided insights into the experiences of engagement and sense of belonging of students who are part of the new majority at a Minority-Serving Institution within a critical socioecological framework to capture the contemporary technology-mediated learning experience. Higher education continues to rely on technology to deliver the learning experience throughout the student lifecycle and therefore it is important to know how students experience technology. Students who have historically been minoritized in higher education disproportionately attend broad access institutions and there are persistent gaps in outcomes like retention and graduation. One way to close gaps is to take greater care to learn about these experiences so that institutions are better able to support their success.

The findings in this study offer insights into experiences of the new majority at an under-researched institutional type. On the one hand, these were consistent with findings that transfer students, low-income and working-class students, and parenting students engage differently than their counterparts, yet on the other hand, traits which have been found to influence belonging, like race, ethnicity, and first-generation status, were not found to be significant. These findings lend support for an ecological model to understand the ways in which student traits, institutional

policy, practice, systems, and people, and external systems interact. Within this context, traits like being an online learner or a caregiver, become salient in shaping engagement and belonging.

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Appendix A

Student Survey

Student Sense of Belonging	
Sense of Belonging Scale	How welcoming have you found NLU to be? (1 = not at all welcoming; 2 = slightly welcoming; 3 = somewhat welcoming; 4 = quite welcoming; 5 = extremely welcoming) How well do people at NLU understand you as a person? (1 = do not understand at all; 2 = understand a little; 3 = understand somewhat; 4 = understand quite a bit; 5 = completely understand) How connected do you feel to staff at NLU, i.e. Advisor, Coach, Student Affairs staff? (1 = not at all connected; 2 = slightly connected; 3 = somewhat connected; 4 = quite connected; 5 = extremely connected) How much respect do other NLU students show toward you? (1 = no respect at all; 2 = a little bit of respect; 3 =some respect; 4 = quite a bit of respect; 5 = a massive amount of respect) How much respect do NLU staff show toward you? (1 = no respect at all; 2 = a little bit of respect; 3 =some respect; 4 = quite a bit of respect; 5 = a massive amount of respect) How much respect do NLU professors show toward you? (1 = no respect at all; 2 = a little bit of respect; 3 =some respect; 4 = quite a bit of respect; 5 = a massive amount of respect) How much do you matter to others at NLU? (1 = do not matter at all; 2 = matter a little bit; 3 = matter somewhat; 4 = matter quite a bit; 5 = matter a massive amount)

Campus Climate	
Experienced discrimination–exclusion	I have been insulted or threatened by other students because of one or more of my identities (race, ethnicity, gender, sexual orientation). (1 = Not at all; 2 = Sometimes; 3 = Frequently) I have heard professors make inappropriate comments about people because of one or more of their identities (race, ethnicity, gender, religion, sexual orientation, country of origin). (1 = Not at all; 2 = Sometimes; 3 = Frequently) I have felt uncertain about being welcome in a classroom because of one or more of my identities (race, ethnicity, gender, religion, sexual orientation, country of origin). (1 = Not at all; 2 = Sometimes; 3 = Frequently) I have felt excluded from school activities because of my race or ethnicity. (1 = Not at all; 2 = Sometimes; 3 = Frequently)
Perceptions of campus racial-ethnic tension	There is a lot of campus racial conflict at NLU. (1 = strongly agree; 2 = somewhat agree; 3 = somewhat disagree; 5 = strongly disagree) Students of different racial/ethnic origins communicate well with one another. (1 = strongly agree; 2 = somewhat agree; 3 = somewhat disagree; 5 = strongly disagree) There is little trust between minority student groups and college administrators. (1 = strongly agree; 2 = somewhat agree; 3 = somewhat disagree; 5 = strongly disagree)
Engagement with EdTech Tools	
Technology use	Share how often you use these NLU technology: NLU Navigate Student app? (Daily, A few times weekly, A few times monthly, A few times each academic quarter, A few times each year, Never) NLU's D2L Online Campus (web or Pulse app)?

	(Daily, A few times weekly, A few times monthly, A few times each academic quarter, A few times each year, Never) NLU's Eagle Life app? (Daily, A few times weekly, A few times monthly, A few times each academic quarter, A few times each year, Never)
Technology connection	Share how connected you feel when you use NLU technology: Navigate Student app makes me feel connected to NLU staff, i.e. Advisor, Coach, Learning Support Specialist, etc. (I do not use this NLU technology; Strongly disagree; Somewhat disagree; Neither agree nor disagree; Somewhat agree; Strongly agree) Navigate Student app makes me feel connected to NLU staff, i.e. Advisor, Coach, Learning Support Specialist, etc. (I do not use this NLU technology; Strongly disagree; Somewhat disagree; Neither agree nor disagree; Somewhat agree; Strongly agree) D2L Online Campus (web or Pulse app) makes me feel connected to my professors. (I do not use this NLU technology; Strongly disagree; Somewhat disagree; Neither agree nor disagree; Somewhat agree; Strongly agree) D2L Online Campus (web or Pulse app) makes me feel connected to other NLU students. (I do not use this NLU technology; Strongly disagree; Somewhat disagree; Neither agree nor disagree; Somewhat agree; Strongly agree) Eagle Life app makes me feel connected to other NLU students. (I do not use this NLU technology; Strongly disagree; Somewhat disagree; Neither agree nor disagree; Somewhat agree; Strongly agree) D2L Online Campus (web or Pulse app) makes me feel connected to NLU.

	(I do not use this NLU technology; Strongly disagree; Somewhat disagree; Neither agree nor disagree; Somewhat agree; Strongly agree)
Navigate Student (EAB) app use	Do you have the Navigate app on a mobile device? (Yes, No) Yes: Which functions do you use in the Navigate app (choose all that apply): (View class schedule; Make appointments; Use study buddies; View holds; Look up NLU resources; Manage to do items; Other) No: What is the reason you have not downloaded the Navigate app? (I was not aware the app existed; I do not think the app will be useful to me; I previously downloaded it, but have since deleted it; I use the desktop version; Other)
D2L/Pulse app use	Do you have the D2L Pulse app on a mobile device? (Yes, No) Yes: Which functions do you use in the D2L Pulse app (choose all that apply): (View class schedule; Complete class assignments; Contact my professor; Contact my classmates; See NLU resources; Other) No: What is the reason you have not downloaded the D2L Pulse app? (I was not aware the app existed; I do not think the app will be useful to me; I previously downloaded it, but have since deleted it; I use the desktop version; Other) Which functions do you use in the desktop version of D2L's Online Campus? Check all that apply: (I do not use the web version; View class schedule; Complete class assignments; Contact my professor; Contact my classmates; Look up NLU resources; Other)
Eagle Life app use	Do you have the Eagle Life app on a mobile device? (Yes, No) Yes: Which functions do you use in the D2L Pulse app (choose all that apply):

	(Sign up for campus events; Join student organizations; Look up NLU resources; Other) No: What is the reason you have not downloaded the D2L Pulse app? (I was not aware the app existed; I do not think the app will be useful to me; I previously downloaded it, but have since deleted it; I use the desktop version; Other)
Student Traits	
Student type	What is your college experience? (Only NLU: This is my first term at NLU; Only NLU: I have been a student at NLU for more than this term; Transfer: This is my first term at NLU and I have taken college classes since high school somewhere other than NLU; Transfer: This is not my first term at NLU and I have taken college classes since high school somewhere other than NLU)
Program major	What is your major? (Free response ___) Coded to business and tech; education; social and behavioral sciences
Gender identity	How do you describe your gender identity? (Free response ___; Prefer not to answer) Coded to Male, Female, Nonbinary, Undisclosed/Unknown
Age	How old are you? (Free response ___) Coded to Gen Z, Millennial, Gen X, Baby Boomer
First-generation status	What is the highest level of education completed by either of your parents or primary caregiver? Some high school; High school diploma or equivalent; Some college; Associate degree or certificate; Bachelor's degree; Master's degree (MA, MEd, MS, MBA, etc.); Professional or doctoral degree (PhD, JD, MD, etc.)) Coded to First-gen, Continuing gen

Race or ethnicity	What is your racial or ethnic identity? (American Indian or Alaska Native, Asian or Asian American, Black or African American, Hispanic or Latino/a/x, Native Hawaiian or other Pacific Islander, White, Two or More Races, I prefer not to respond, Other) Coded to American Indian or Alaska Native, Asian or Asian American, Black or African American, Hispanic or Latiné, Hawaiian or other Pacific Islander, White, Two or More Races, Unknown
Social class	Which term best describes your social class identity? (Wealthy, Upper middle class, Middle class, Working class, Low income or poor, Prefer not to say) (Recode to Working Class/Low Income/Poor, Wealthy/Middle Class/Unknown)
Grades	What is your current NLU GPA? (0-1.9; 2-2.9; 3-3.9; 4.0; I do not have an NLU GPA)
Course modality	What best describes your class schedule for this quarter? (In-person classes only; Zoom only; Online classes only; A combination of in-person, Zoom, or online classes)
Weekly hours worked	When school is in session, how many hours do you usually work each week at a paid job? Include on and off campus work. (0, 1-10, 11-20, 21-30, more than 30)
Caregiving responsibilities	When school is in session, what caregiving responsibilities do you have in a normal week? Choose all that apply: (None; Primary caregiver for my own child/children; Occasional caregiver of my own child/children; Primary caregiver for family members (sibling, cousin, parent, grandparent, aunt, uncle, etc.); Occasional caregiving for family members (sibling, cousin, parent, grandparent, aunt, uncle, etc.); Other) Coded to Caregiver (Primary), Caregiver (Any), Not Caregiver

Institutional commitment	How happy are you with your choice to be a student at NLU? (1 = not at all happy; 2 = slightly happy; 3 = somewhat happy; 4 = very happy; 5 = extremely happy) How important is it for you to graduate from college? (1 = very important; 2 = slightly important; 3 = somewhat important; 4 = slightly unimportant; 5 = not at all important) Do you plan to complete your degree at NLU? (1 = yes, definitely; 2 = yes, probably; 3 = maybe not; 4 = definitely not)

Campus Climate

Experienced Discrimination – Exclusion (Hurtado & Carter, 1997)	I have been insulted or threatened by other students because of one or more of my identities (race, ethnicity, gender, sexual orientation). (1 = Not at all; 2 = Sometimes; 3 = Frequently) I have heard professors make inappropriate comments about people because of one or more of their identities (race, ethnicity, gender, religion, sexual orientation, country of origin). (1 = Not at all; 2 = Sometimes; 3 = Frequently) I have felt excluded from school activities because of my race or ethnicity. (1 = Not at all; 2 = Sometimes; 3 = Frequently)
Perceptions of Campus Racial-ethnic Tension (Hurtado & Carter, 1997)	There is a lot of campus racial conflict here. (1 = strongly agree; 2 = somewhat agree; 3 = somewhat disagree; 5 = strongly disagree) Students of different racial/ethnic origins communicate well with one another. (1 = strongly agree; 2 = somewhat agree; 3 = somewhat disagree; 5 = strongly disagree)

	There is little trust between minority student groups and college administrators. (1 = strongly agree; 2 = somewhat agree; 3 = somewhat disagree; 5 = strongly disagree

Engagement with EdTech Tools

Technology Use	How often do you use NLU's Navigate Student (EAB) app? (Daily, a few times weekly, a few times monthly, a few times each academic quarter, a few times each year, never) How often do you use NLU's D2L online campus (web or Brighstpace app)? (Daily, a few times weekly, a few times monthly, a few times each academic quarter, a few times each year, never) How often do you use NLU's Eagle Life (Presence) app? (Daily, a few times weekly, a few times monthly, a few times each academic quarter, a few times each year, never)
Navigate Student (EAB) App Use	Do you have the Navigate App on a mobile device? (Yes, No) No: What is the reason you have not downloaded this app? (I was not aware the app existed; I do not think the app will be useful to me; I previously downloaded it, but have since deleted it; I use the desktop version; Other) Yes: Which functions do you use in the app (check all that apply): (Class schedule; Schedule appointments; Study buddies; View holds; See NLU resources; Manage to do's; Other)
D2L Brighstpace App Use	Do you have the D2L Pulse App on a mobile device?

	(Yes, No) No: What is the reason you have not downloaded this app? (I was not aware the app existed; I do not think the app will be useful to me; I previously downloaded it, but have since deleted it; I use the desktop version; Other) Yes: Which functions do you use in the app (check all that apply): (Class schedule; Complete class assignments; Contact my professor; Contact my classmates; See NLU resources; Other) Yes: Which functions do you use in the web-based D2L (check all that apply): (I do not use the web version; Class schedule; Complete class assignments; Contact my professor; Contact my classmates; See NLU resources; Other)
Eagle Life App Use	Do you have the Eagle Life (Presence) App on a mobile device? (Yes, No) No: What is the reason you have not downloaded this app? (I was not aware the app existed; I do not think the app will be useful to me; I previously downloaded it, but have since deleted it; I use the desktop version; Other) Yes: Which functions do you use in the app (check all that apply): (Sign up for campus events; Join student organizations; See NLU resources; Other)
Student Traits	
Student Type	What is your college experience? (Only NLU and this is my first term at NLU, Only NLU for more than this term, Transfer: I have taken college classes somewhere other than NLU and this is my first term at NLU, Transfer: I have taken college classes somewhere other than NLU and this is not my first term at NLU)

Program Major	What is your major? (Free Response ___; Undecided) (Recode to Education, Business & Technology, Social and Behavioral, Undecided)
Gender Identity (ACPA Standards for Demographic Questions, 2013)	How do you describe your gender identity? (Free Response ___; Prefer not to answer) (Recode to 0 = Female, 1 = Male, 9 = Other)
First-generation Status	What is the highest level of education completed by either of your parents or primary caregiver? Some high school; High school diploma or equivalent; Some college; Associate's degree or certificate; Bachelor's degree; Master's degree (MA, MEd, MS); Professional or doctoral degree (PhD, JD, MD, etc.) (Recode to First generation status 0 = No, 1 = Yes)
Race or Ethnicity	What is your racial or ethnic identity? (American Indian or Alaska Native, Asian or Asian American, Black or African American, Hispanic or Latino, Native Hawaiian or other Pacific Islander, White, Other, I prefer not to respond)
Social Class	Which term best describes your social class identity? (Wealthy, Upper middle class; Middle class; Working class; Low income or poor) (Recode to Low-income status 0 = No, 1 = Yes)
Grades	What is your current NLU GPA? (0-1.9; 2-2.9; 3-3.9; 4.0)
Course modality	What best describes your class schedule for this quarter? (In-Person only (Wheeling or Chicago); In-person only; Zoom only; Online only (no scheduled class sessions); A combination of in-person, Zoom, or online)
Weekly work hours	When school is in session, how many hours do you usually work each week? (0, 1-10, 11-20, 21-30, more than 30)

Weekly caregiving responsibilities	When school is in session, what caregiving responsibilities do you have in a normal week? (check all that apply) (None; Take care of my own child/children; Primary caregiver for older family members (grandparents, parents, aunts, uncles, etc.); Occasional caregiver for family members (siblings, cousins, parent, grandparent)
Institutional Commitment (Hausmann et al., 2009)	How happy are you with your choice to be a student at NLU? (1 = not at all happy; 2 = slightly happy; 3 = somewhat happy; 4 = very happy; 5 = extremely happy) How important is it for you to graduate from college. (1 = very important; 2 = slightly important; 3 = somewhat important; 4 = slightly unimportant; 5 = not at all important) Do you plan to complete your degree at NLU? (1 = yes, definitely; 2 = yes, probably; 3 = maybe not; 4 = definitely not)

Appendix B

Survey Recruitment Sample

Undergraduate College Annual Student Survey: Introduction and Informed Consent

The Undergraduate College (UGC) at NLU has a mission to provide a rigorous, technology-enhanced, affordable college education in a supportive environment that respects diversity in order to help all students meet and surpass their personal, academic, and career goals. Student feedback helps the College to know how we're doing.

You're invited to participate in this survey exploring UGC student experience at NLU, your perception of campus culture, and the NLU technology you use. The survey is expected to take approximately 10-15 minutes and is a one-time survey.

Completing the survey may cause some discomfort for students who have experienced or witnessed incidents of bias. Students who experience discomfort and no longer wish to continue the survey may close out of the browser. University counseling resources are available to anyone seeking support. There are no known direct benefits to you from participating in this survey. It is hoped that students will benefit from responses collected from this annual survey as the information is used to improve the overall UGC student experience in the future.

The data collected in this survey is anonymous and the information you choose to provide in this survey will not be connected back to you. Results from this survey may be published or presented at NLU or at research conferences and the anonymous data may be shared with researchers through secure online data repositories.

Your participation is voluntary and you may discontinue your participation at any time by closing the browser.

If you have questions or concerns about this survey, you may contact Veronica Wilson at [redacted] or the Undergraduate College Dean's Office at [redacted]

For questions about your rights in this survey or Institutional Research and Review Board (IRRB) approval, contact Shaunti Knauth, IRB Chair and Director of Engaged Research, [redacted]

I have read and understand this consent form. By clicking the "Next" button to start the survey, I am expressing my willingness to voluntarily participate in this survey.

[NEXT]

Appendix C

Codebook

1 Belonging

Use for comments regarding sense of belonging or feelings of presence or absence of welcome, connection, or respect.

1.1 Belonging\Positive

Use to capture comments with any mention of a positive affective quality such as feeling welcome, respected, supported, or gratitude; or being connected to NLU, students, staff, or faculty.

1.2 Belonging\Negative

Use to capture comments with any mention of a negative affective quality such as feeling unwelcome, disrespected, experiencing discrimination, or overwhelm; or being disconnected to NLU, students, staff, or faculty.

1.3 Belonging\Neutral

Use to capture comments that mention feeling welcomed, respected, or connected that do not include a positive or negative affective quality.

1.4 Belonging\Tech

Use to identify comments describing technology influencing sense of belonging, welcome, respect, or connection in both positive and negative ways.

1.5 Belonging\Online

Use for comments mentioning being an online student with respect to engagement or sense of belonging.

2 Technology

Use for comments about the use of EdTech tools or technology at NLU.

2.1 Technology\Positive

Use to capture comments with a positive affective quality, such as ease of use or helpful.

2.2 Technology\Negative

Use for comments with a negative affective quality, such as challenges or issues using technology, dissatisfaction with how technology is used, or lack of interest in or desire to use apps.

2.3 Technology\Learning

Use for comments about learning how to use technology, time to master technology, or technological skills gained.

2.4 Technology\Awareness

Use for comments regarding not knowing about an EdTech tool, learning about an EdTech tool through the survey, or an intention to use an EdTech tool or app now.

2.5 Technology\D2L

Use for comments about using D2L.

2.6 Technology\Eagle Life

Use for comments about using D2L.

2.7 Technology\Navigate

Use for comments about using Navigate Student.

3 Experience

Use for general comments referencing experiences, such as a specific positive or negative interaction or situation or a desire to have a specific or different experience.

3.1 Experience\Student

Use for references to their experience that mentions other NLU students.

3.2 Experience\Professor

Use for comments about their experience that mentions professors (in general or a specific name).

3.3 Experience\Staff

Use for comments about their experience that mentions NLU staff (in general, a role, department, or specific name).

3.4 Experience\Academic

Use for comments describing the academic or classroom experience, including work load, learning experience, or the curriculum.

3.5 Experience\Positive

Use to capture comments about experience that have a positive affective quality and use words like friendly or helpful to describe the experience.

3.6 Experience\Negative

Use for comments about an experience that have a negative affective quality and mention words such as disrespectful, challenge, lack of trust, or disappointment.

3.7 Experience\Financial Hardship

Use for passages referencing financial strain or hardship related to NLU.

3.8 Experience\Resources

Use for mentions of the use of specific resources, or the presence or absence of resources.

3.9 Experience\Service

Use for comments describing service, expectations, or the quality of service.

4 Traits

Use for discussions of student traits, qualities, identities, or experiences that influence their belonging or engagement in positive or negative ways.

4.1 Traits\Belonging

Use for mentions of a student trait or identity (transfer, age, race or ethnicity, gender, caregiving role, employment) and sense of belonging, welcome, respect, and engagement.

4.2 Traits\Technology

Use for comments about using technology and mention of a student trait (age, transfer, gender, caregiving, employment, being an online student).

5 Suggestions

Use for comments with suggestions, improvements, or constructive feedback regarding technology, systems, or the student experience.

5.1 Suggestions\Tech

Use for suggestions or constructive feedback regarding systems or technology.

5.2 Suggestions\Resources

Use for suggestions or feedback regarding resources available to students.

5.3 Suggestions\KnowledgeSkills

Use for suggestions or constructive feedback about skills, knowledge, or training opportunities for faculty or staff.

Appendix D

IRB Approval

NATIONAL LOUIS UNIVERSITY
1886
ACCESS. INNOVATION. EXCELLENCE.

Office of the Provost
122 South Michigan Avenue
Chicago, Illinois 60603-6162

www.nl.edu
P/F 312.261.3121

December 12, 2023

Veronica Wilson
[redacted]

Dear Veronica Wilson:

The Institutional Review Board (IRB) has received your application for your research study "*Undergraduate Student Sense of Belonging and the Virtual Campus Environment*" IRB has noted that your application is complete and that your study has been approved by your primary advisor and an IRB representative. Your application has been filed as Expedited in the Office of the Provost.

IRB: ER01321
Please note that the approval for your study is for one year, from **8-Dec-2023 to 8-Dec-2024**.

As you carry out your research, you must report any adverse events or reactions to the IRB. At the end of your approved year, please inform the IRB in writing of the status of the study (i.e., complete, continuing). During this time, if your study changes in ways that impact human participants differently or more significantly than indicated in the current application, please submit a Change of Research Study form to the IRB, which may be found on NLU's IRB website.

All good wishes for the successful completion of your research.

Sincerely,

Shaunti Knauth

Shaunti Knauth, Ph.D.
Chair, IRB

Appendix E

IRB Amended Approval

NATIONAL LOUIS UNIVERSITY
1886
ACCESS. INNOVATION. EXCELLENCE.

Office of the Provost
122 South Michigan Avenue
Chicago, Illinois 60603-6162

www.nl.edu
P/F 312.261.3121

February 8, 2024

Veronica Wilson
[redacted]

Dear Veronica Wilson:

The Institutional Review Board (IRB) has received your application for amendment of your research study "*Undergraduate Student Sense of Belonging and the Virtual Campus Environment*". The amendment is approved.

IRB: ER01321
Amendment approved 7-Feb-2024

Please note that the approval for your study is for one year, **from 8-Dec-2023 to 8-Dec-2024**. As you carry out your research, you must report any adverse events or reactions to the IRB.

At the end of your approved year, please inform the IRB in writing of the status of the study (i.e. complete, continuing). During this time, if your study changes in ways that impact human participants differently or more significantly than indicated in the current application, please submit a Change of Research Study form to the IRB, which may be found on NLU's IRB website.

Please also ensure that your Human Subjects Research (HSR) certification stays active throughout any amendments to your research period.

All good wishes for the successful completion of your research.

Sincerely,

Shaunti Knauth

Shaunti Knauth, Ph.D.
Chair, IRB