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Academic Performance Among First-Year College Freshmen Following Participation in a Summer Bridge Program

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ABSTRACT

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The primary purpose of this study was to determine the differences in the academic outcomes of first-year academically underprepared TN Promise-eligible college freshmen who participated in a college bridge program. A comparative research design was applied to existing data, including first-semester GPA, first-semester credit completion rate, first college-level mathematics course GPA, first college-level English course GPA, and fall-to-fall persistence rates. A random sample of 412 first-time freshman college students from five cohorts was analyzed using descriptive statistics for eight research questions. These findings indicated that there were no significant differences among college bridge participants and non-bridge participants. Non-bridge program participants performed slightly better than bridge program participants for all research questions, including first-semester GPA, first-semester credit completion rate, first English course GPA, and first mathematics course GPA. Similar results were also found for research questions that analyzed underrepresented participants. However, despite finding that non-bridge participants achieved minor but consistently higher performance outcomes, the fall-to-fall persistence rates for bridge participants and non-bridge participants were nearly identical. Additional analyses indicated that low-income bridge participants slightly outperformed their low-income non-bridge peers in first-semester GPA and credit completion rate, and first-generation bridge program

participants and first-generation non-bridge participants performed almost identically, though no statistical significance was found. This study documented the short-term academic effects that college bridge programs can have on academically underprepared college freshmen. These findings resemble similar findings from existing bridge program research that likewise did not find improvements in student performance or outcomes. Additionally, this study along with ambiguous findings from previous research, might indicate that bridge program efficacy is highly reliant on program design, purpose, and target populations, and the concept is not a universal approach to prepare students academically and socially for the curricular expectations of postsecondary education. Implications for future research and recommendations for policymakers are discussed.

DEDICATION

I dedicate this to my family and friends. To my mom, dad, brother, Pawpaw, Gran, Leon, and Gina, thank you for always loving and supporting me. To the loving memory of my Nana and Granddad. In the end, I completed this program for you all, and I completed this program because you made it possible.

To my niece, Waverly, you're only two years old right now so you probably won't read this for a few years, but I want you to know that you can do anything you want in life if you work hard, do the right thing, and be considerate to others. Technically you can't do *anything* you want. The laws of nature and society make certain things impossible or imprudent. For example, you can't flap your arms and fly into the endless vacuum of space because of aerodynamics and gravity and other things I don't understand. And you shouldn't try to steal the Mona Lisa or hitch a ride on Air Force One because those things are illegal. But you can become an astronaut if you want, and you can paint the next Mona Lisa if you want, and you can be elected President of the United States if you want. Just stay diligent and motivated and be good. Or be the least bad you can be. By the way, a museum employee at the Louvre stole the Mona Lisa in 1911, so don't give up on that dream yet.

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Chapter 1. Introduction

One of the most important aspects of the community college model is the assurance that all students can benefit from higher education through the concept and practice of open access admission (Shannon & Smith, 2006). Community colleges provide egalitarian admission to students from all socioeconomic and demographic backgrounds and provide entry into higher education to populations who otherwise lack access to selective institutions due to academic or financial limitations. Expanded access to higher education provides myriad benefits to students, including improvements in communication, problem-solving, teamwork, and adaptation to new work requirements (Bok, 2013). The economic benefits of merely attending college or obtaining an associate's degree represent increased lifetime earnings and drastically higher rates of employability relative to a high school diploma (Carnevale et al., 2016). Such economic imperatives associated with higher education are expected to increase as employer requirements continue to rise and employment opportunities require that employees possess advanced credentials and degrees that employers prefer (Bottoms & Sundell, 2017). The opportunity to pursue higher education provided by open access institutions, therefore, represents the prospect of improving students' abilities to work more effectively and to transition into higher economic strata.

However, variations in academic preparedness among students result in disparate outcomes of student performance and success, including differential retention and graduation rates. According to Bok (2013), up to 58% of community college students are required to enroll in remedial courses compared to 25% of students at four-year colleges, and fewer than half of all students who require remediation successfully complete their developmental coursework. Despite comparable performance measurements based on analyses of transcripts, community college students are specifically and substantially more likely to undergo remediation relative to

four-year university students (Monaghan & Attewell, 2015). The high rates of academic unpreparedness and requisite remediation effectively reduce the accessibility of the community college model and diminish the potential personal, financial, and social benefits of unrestricted higher education.

Efforts to remediate students to mitigate the effects of academic unpreparedness include various support services and non-credit developmental or remedial coursework, and these efforts add to the costs of education for students and institutions and diminish the budgetary discretion to improve other college functions. Though developmental courses are beneficial for some significantly underprepared students, this form of remediation does not provide credits, slows students' progress, and has an unverified impact on student success (Park et al., 2018). According to Logue et al. (2017), requiring students to pass remedial courses prior to credit bearing courses increases costs on students, colleges, and taxpayers using resources that could be allocated elsewhere. Developmental courses can be burdensome in that they consume students' financial aid availability and do not contribute to degree progression. In addition to extending students' college enrollment and adding to the costs of a degree, developmental courses can be demoralizing experiences for students (McGlynn, 2012). Despite the many institutional provisions offered to assist underprepared students, the lack of basic reading, writing, mathematics, and computer skills demonstrated by a large proportion of community colleges students threatens to undermine the open access feature that defines these institutions (Shannon & Smith, 2006).

A potential solution to assist academically underprepared college students is an intensive summer bridge program designed to introduce students to the curricular and social expectations of college coursework prior to postsecondary enrollment. Bridge programs consist of both

academic and social aspects that can help students connect with institutions' educational expectations (McCurrie, 2009). Such programs may inculcate students with an academic, social, and postsecondary-minded mentality that could diminish the need to impose non-credit bearing and discouraging remedial courses. Program design can differ in length, content, and intensity based on student needs and institutional resources. The purposes of summer bridge programs likewise vary from the introduction of college skills to peer and cohort socialization, though academic preparation directly addresses curricular deficiencies as indicated by students' low placement test scores and high rates of remedial enrollment. The successful remediation and preparation of a portion of developmental-level incoming students could improve student outcomes and make available institutional resources for other institutional programs and initiatives.

Tennessee (TN) Promise is a financial aid program implemented in fall 2015 and designed to incentivize community college enrollment for Tennessee students. The program serves as a fundamental aspect of the state's economic development-based Drive to 55 initiative meant to increase college attendance and achieve a 55% postsecondary attainment rate among its population (Smith & Bowyer, 2016). As such, it provides a mechanism through which underrepresented and academically underprepared students could seek postsecondary enrollment. According to Mike Krause, former Executive Director of the Tennessee Higher Education Commission, the Promise program can inform school districts of the college-readiness of incoming students (Adams, 2015). Through this comprehensive college program, Tennessee can both influence college enrollment and examine current proficiencies and deficiencies in the state's college pipeline because of the program's expansive coverage and the shifting academic and demographic profiles of its recipients.

Overall higher education enrollment increased by 10% and community college enrollment increased by almost 25% over the prior year's enrollment after the program's implementation in Fall 2015 (Adams, 2015). The increase in enrollment indicated an influx of college students not previously present in the postsecondary pipeline and introduced challenges to service infrastructures. Based on case study analysis of student support administrators at three community colleges, Littlepage et al. (2018) found that the administrators did not accurately anticipate the volume of TN Promise students in need of learning support and remediation, and that remediation needs of the new Promise population strained budgetary and staffing considerations. The advent of a statewide postsecondary initiative with demonstrated enrollment gains presents an opportunity to examine differential rates of academic preparedness, college readiness, and related interventions.

This analysis was conducted based on student data and summer bridge program participation at one open access community college in southeastern Tennessee with an approximate annual enrollment of 8,000 students. As this summer bridge program was designed for and implemented on behalf of TN Promise-eligible freshmen determined as academically underprepared based on college placement tests, samples of program participants and non-bridge participants were derived from the Promise-eligible freshman population of more than 1,000 students each fall semester. All bridge participants and non-bridge participants were determined to require at least one remedial course based on an initial placement test and the absence of a qualifying ACT or SAT score.

A comparative examination of student outcomes, including GPA, credit progression, and student persistence, can indicate the efficacy of bridge programming. Likewise, an analysis of outcomes for students who completed an academic intervention might inform the extent to which

Promise and similar programs influence the postsecondary pipeline among underrepresented and academically underprepared students whose educational objectives rely on institutional preparation and additional support mechanisms.

Statement of the Problem

College access has expanded in recent decades and resulted in an increase in the rate of students who require remedial or developmental courses in reading, writing, or mathematics necessary to progress to college-level coursework, including 68% of community college students who are required to take at least one remedial course (Chen & Simone, 2016). Postsecondary enrollment estimates from the National Center for Education Statistics (n.d.) indicated that more than 19.9 million students were expected to attend college in fall 2019, with that number expected to steadily increase to more than 20.3 million students by 2028. Based on these estimates, the total population in need of remediation would account for millions of currently enrolled students, primarily at community colleges. Because academic preparedness positively correlates to higher GPAs and graduation rates, students who are academically underprepared, particularly low-income and minority students, conversely experience lower GPAs and graduation rates (Kodama et al., 2018). Problems posed by academic unpreparedness and insufficient redress could increase proportionately as new students are added to higher education enrollments each year.

The prospect of the expansion of last-dollar tuition programs like TN Promise, including national initiatives by organizations like Lumina Foundation and regional programs like the Philadelphia Education Fund and the District of Columbia College Access Program, have the potential to compound remediation needs as such programs are expected to expand postsecondary enrollment to students who would otherwise have no likelihood of enrolling in

college (Littlepage et al., 2018). Among students in southern states, including Tennessee, less than 40% meet the college readiness expectations of their respective states (Bottoms & Sundell, 2017). Academic unpreparedness, therefore, represents a barrier to higher education access and attainment for a significant and potentially increasing number of students, including most community college students.

College retention and completion is particularly important for job outcomes and individual income. According to Carnevale et al. (2013), 65% of jobs will require postsecondary education beyond high school by 2020. As postsecondary education has been established as a necessity for individuals who seek stable employment and a middle-class income, states with higher rates of college graduates are similarly more prosperous than states with lower rates (Fairweather & Hodges, 2006). However, college students whose enrollment is prolonged or curtailed by a lack of academic preparedness are less likely to graduate and benefit from and contribute to the economic advantages of postsecondary education. According to data from the National Student Clearinghouse (2019), students who began college in fall 2017 at any type of institution persisted to fall 2018 at a rate of 73.8%, though disparities in retention exist between students from Asian and white ethnic backgrounds and African American and Hispanic students.

The rate and intensity of remediation among students at two-year institutions is significant. According to Chen and Simone (2016), 68% of beginning postsecondary students at two-year institutions in the 2003-2004 academic year took at least one remedial course and nearly half of those students took two or more remedial courses during that period. Additionally, 16% of remedial students failed to complete any developmental courses, while 35% completed some but not all their developmental courses. The regularity and constancy of remedial education is estimated to cost states and students at least $1.3 billion each year (Logue et al., 2017).

According to Scott-Clayton and Rodriguez (2015), remedial credits represent approximately 10% of all credits earned at community colleges. Based on estimated rates of remediation and subsequent stop-outs, millions of students and hundreds of institutions are further subjected to additional expenses and opportunity costs associated with academic unpreparedness. High rates of stop-outs and discontinued enrollment likewise reduce revenue generated through performance-based funding models; thus, some community colleges have sought to limit admissions to students who are less likely to graduate, or inflate the rate of admissions and institutional bandwidth to students from higher-performing high schools to mitigate the effects of lower-performing students (Dougherty et al., 2014). Financial constraints and external pressures related to academic unpreparedness threaten to limit postsecondary access and impede labor market entry, economic gains, and socioeconomic mobility that many underrepresented and low-income students seek through higher education.

Administration of placement testing and developmental and remedial coursework are strategies intended to bridge the misalignment between some students' lack of curricular preparation and the expectations of rigorous postsecondary education. Despite its prevalence throughout higher education, the benefits of developmental education are not conclusively determined (Monaghan & Attewell, 2015). However, the disproportionate impact of remediation among community college students, coupled with their comparatively high stop-out rates and lower attainment rates, necessitates further investigation into alternatives to the current paradigm of academic rehabilitation. In addition to programming that addresses academic deficiencies, recent research has determined that noncognitive factors, including behaviors, skills, and attitudes associated with postsecondary success, are essential to students' success in college (Nagaoka et al., 2013).

Therefore, alternatives to the current system of academic rehabilitation for at-risk students which can address both academic and noncognitive deficiencies are imperative because of the educational, social, and economic costs associated with academic unpreparedness. According to the Community College Research Center at Columbia University, fewer than 25% of students who require remediation earn a college credential within eight years (Bottoms & Sundell, 2017). Resolution of postsecondary deficiencies among incoming freshmen prior to their enrollment could contribute to some improvement of completion rates and address to some extent the costs associated with developmental coursework and the lack of higher education parity among students from disparate socioeconomic or racial backgrounds.

Potential solutions to the problems of academic unpreparedness and lower retention and persistence rates experienced by academically underprepared students include iterations of remedial and developmental coursework in students' initial semesters. However, the utility and efficacy of developmental coursework is not determinative. Martorell and McFarlin (2011) analyzed academic and labor market outcomes of a large sample of Texas students and found that remediation had a small negative effect on total attempted academic credits and the probability of completing at least one year of college. According to Xu and Dadgar (2018), academically underprepared students are negatively affected by the additional costs of remedial courses that do not contribute to degrees and the additional time spent in the classroom for courses that present barriers to college-level progression.

Significance of the Study

Bridge program participation could serve as a pre-enrollment intervention to remediate incoming college students and improve rates of academic performance, persistence, and graduation. Policy makers and practitioners invested in improving access and retention,

especially among students who are more at-risk of discontinued enrollment due to background characteristics such as income, could benefit from alternative methods of college preparation and inculcation. Therefore, a comparative analysis of academically underprepared bridge program participants and non-bridge participants could indicate a relatively inexpensive, effective method of introducing postsecondary capacities to ensure students are able to successfully navigate college-level curricula and matriculate from enrollment to graduation or university transfer.

The data examined in this study and the conclusions arrived at therein can be applied to the broader environment of developmental-level students and bridge programs and the differential outcomes experienced by students whose preparation for college was deemed insufficient even at open access institutions. Currently, there exists a paucity in the volume of empirical studies analyzing the efficacy of different types of summer bridge programs on academic outcomes and postsecondary decisions, and many analyses are instead descriptive in approach (Kitchen et al., 2018; Sablan, 2014; Strayhorn, 2011). Existing literature has provided inconclusive, contradictory indications of the effects of remediation on college students, though much of this analysis is limited to students only marginally underprepared (Xu & Dadgar, 2018). Modest gains among bridge participants have been identified by several studies, though the utility of bridge programs has remained unsettled. For instance, Cancado et al. (2018) conducted a logistic regression analysis on a population of bridge participants and found that an increase in two-year retention rates for students with Math ACT scores in the middle range but found no statistically significant benefits for participants with low or high Math ACT scores. Minor improvements were also identified by Wathington et al. (2016), though the authors determined that bridge programs might be better implemented as complementary interventions in a series of support mechanisms for students in need of developmental curriculum.

To that end, this analysis is intended to provide a comparative examination of student outcomes following their participation in a summer bridge program. Specifically, participants will represent an academically at-risk population that likewise demonstrates other demographic attributes associated with lower college success rates, including underrepresented minorities and low-income students (Kallison & Stader, 2012; McCurrie, 2009). Appropriately researched and analyzed findings and accompanying descriptions of bridge program components can inform future programmatic designs or additional analyses of existing bridge programs. Disaggregation of participant demographics and outcomes can further add to the current body of bridge program research and help determine the efficacy of pre-enrollment interventions for students at risk of entering postsecondary education with debilitating academic deficiencies.

Purpose of the Study

This comparative study was conducted to examine and characterize the effects of summer bridge program participation among academically underprepared incoming college freshmen. Additionally, this analysis will demonstrate what differential effects, if any, are experienced by bridge program participants based on demographic attributes. A lack of statistically significant differences in bridge participant outcomes could inform programmatic adjustments or additional alternatives to academic interventions.

Research Questions

This study will focus on the following research questions:

1. Is there a significant difference in first-semester GPA between bridge program participants and non-bridge participants?
2. Is there a significant difference in first-semester credit hour completion rates between bridge program participants and non-bridge participants?

3. Is there a significant difference in fall-to-fall persistence rates between bridge program participants and non-bridge participants?
4. Is there significant difference in first college-level Mathematics course GPA between bridge program participants and non-bridge participants?
5. Is there a significant difference in first college-level English course GPA between bridge program participants and non-bridge participants?
6. Is there a significant difference in first-semester GPA between underrepresented bridge program participants and underrepresented non-bridge participants?
7. Is there a significant difference in first-semester credit hour completion rates between underrepresented bridge program participants and underrepresented non-bridge participants?
8. Is there a significant difference in fall-to-fall persistence rates between underrepresented bridge program participants and underrepresented non-bridge participants?

Limitations and Delimitations of the Study

This study presented several limitations to the flexibility and applicability of the results. This analysis was unable to control for differences in the schedules, instructors, support services, or academic and non-curricular provisions provided in each bridge program in cohort years 2015, 2016, 2017, 2018 and 2019. Likewise, the institution at which the bridge program was conducted used two different but comparable placement exams during the period under analysis; entering freshmen in each cohort might have been determined as developmental-level based on equivalent results from either an EdReady placement test or an ACCUPLACER placement test. Beginning in 2019 and outside the scope of this analysis, the institution discontinued use of EdReady as an option for placement testing.

However, the differences in the designs and purposes of bridge programs across all institutions parallels the variations present in the 2015, 2016, 2017, 2018, and 2019 cohort programs analyzed in this study. Bridge programs serve various purposes at different institutions, including socialization, study skills, academic skills, or college life skills. Likewise, faculty and teachers vary between college credit courses that are often comparatively examined for the purposes of statistical analysis. Finally, the purpose of placement tests is to provide consistent, comparable determinations of students' academic capacities relative to college-level curriculum. Whether participants were determined to need remedial coursework by ACCUPLACER or EdReady is not a limiting factor for the purposes of this study as the determinations of college-readiness are assumed to be consistent and comparable across multiple test formats. The variations in placement tests, bridge instructors, and programmatic offerings are mitigated by all other controls and consistencies inherent in this analysis.

Definitions of Terms

The following terms and definitions were referenced in this study:

ACCUPLACER. An untimed, computerized, adaptive placement test used to determine incoming college students' readiness to enroll in college-level coursework (Medhanie et al., 2012). ACCUPLACER is considered equivalent to EdReady for placement purposes within the context of this study.

Bridge program. An academic intervention designed to prepare various groups of incoming college students, including academically underprepared students, underrepresented students, STEM students, and residential and commuter students, for college-level coursework to improve persistence and completion (Raines, 2012).

COMPASS Test. A discontinued, computerized tool produced by ACT, Inc. to assess college students' abilities in reading, writing, and mathematics for the purposes of placement into developmental coursework (Fain, 2015).

Developmental. Students or coursework that demonstrates a lack of preparedness for college-level curriculum as determined by the placement standards and placement test outcomes of an institution of enrollment. This term is used interchangeably with remediation and remedial coursework. See the definition for Remediation for a detailed description of this preparatory strategy.

EdReady Test. A low-stakes, adaptive electronic assessment tool designed to prepare students for college-level curriculum using personalized study paths in English, Math, and Algebra (Network Resources Open College & Career Project, n.d.). EdReady is considered equivalent to ACCUPLACER for placement purposes within the context of this study.

First-generation students. For the purposes of this study, first-generation students are defined as students who responded that neither household parent obtained a college degree or higher on the Free Application for Federal Student Aid (FAFSA) of their respective freshman year. First-generation students are a subgroup of underrepresented students in the analyses of this study. All students in this study completed a FAFSA and responded to this question.

Low-income students. For the purposes of this study, low-income students are defined as eligible for Pell Grant based on the Expected Family Contribution (EFC) on the FAFSA of their respective freshman year. Low-income students are a subgroup of underrepresented students in the analyses of this study. All students in this study completed a FAFSA and responded to this question.

Overplacement. Curricular placement wherein a student is unprepared for the courses in which they are enrolled based on an error in placement testing (Scott-Clayton et al., 2014).

Persistence. The rate at which students continue enrollment or degree completion at any institution of higher education, regardless of where they initially enrolled (National Student Clearinghouse, 2019). For the purposes of this study, persistence indicates students' continued enrollment from fall-to-fall semester regardless of academic performance in their initial semester.

Remediation. A strategy that typically involves preparatory coursework intended to "address a perceived lack of preparation among incoming college students" (Scott-Clayton & Rodriguez, 2015, p. 5). Students are placed in remediation based on pre-entry college assessments or a lack of curricular preparation as demonstrated by high school performance measurements and standardized tests.

Retention. The rate at which students begin enrollment at a single institution and continue enrollment into the following fall semester at the same college or university (National Student Clearinghouse, 2019). This can be considered as the institutional perspective of students' persistence.

Underplacement. Curricular placement wherein a student is enrolled in developmental coursework based on an assessment error despite being prepared for higher level coursework (Scott-Clayton et al., 2014).

Underrepresented minority students. For the purposes of this study, underrepresented minority students are students who self-identified as any non-White race or ethnicity on their college admissions application. Underrepresented minority students are a subgroup of underrepresented students in the analyses of this study.

Underrepresented students. For the purposes of this study, underrepresented students are students who are historically less likely to enroll in higher education than ethnically white and higher income students, including low-income students, first-generation students, and Alaskan Native, American Indian, Asian, Black, Hispanic, and Native Hawaiian or Pacific Islander students (Pitre & Pitre, 2009).

Overview of the Study

This study was designed and conducted to determine if TN Promise-eligible, non-college ready summer bridge program participants performed better academically in their freshman year compared to TN Promise-eligible, non-college ready students who did not participate in a summer bridge program. Chapter 1 presents a summary of the context of this analysis, including background information regarding the Promise program, college preparedness, and the importance of postsecondary access, persistence, and completion. Chapter 2 provides an in-depth review of existing literature of developmental coursework, placement testing, community college access, bridge programs, TN Promise, and the intersection of these topics. Chapter 3 describes the methodology and statistical analyses conducted on the academic data derived from bridge participants and non-bridge participants. Chapter 4 presents the results and findings of the research. Chapter 5 summarizes the findings and provides recommendations for future research.

Chapter 2. Review of Relevant Literature

Inclusion and Exclusion Criteria

Considerations for the inclusion of research throughout this dissertation include the recency of cited research, the relevancy of related research and research topics to the current state of postsecondary education, the importance of foundational literature that influences recent research, and the validating authority of publication of referenced literature.

Justifications for Inclusion

Most references cited throughout this dissertation reflect recent publications and research dating from 2010 through 2020, with a majority being published in 2015 or later. Some articles, periodicals, and books cited in this analysis include foundational literature commonly referenced in more recent and contemporary studies.

The relevance of referenced literature is the primary justification for inclusion within this literature review. College bridge programs are intended to improve postsecondary access, persistence, and degree attainment for underprepared students otherwise at risk of early stop-outs, particularly for underrepresented and low-income students whose remedial placement outpaces that of their peers (Hu et al., 2016). If successful, such programs present a potential alternative to the predominant paradigm of placement testing and development or remedial coursework that correlates to the accumulation of non-credit classes that do not contribute to degree completion (Wathington et al., 2016). Improved rates of access, retention, and college completion each influence postsecondary outcomes for underprepared students.

In addition to the recency and relevance of publications referenced throughout this dissertation, the authority by which these sources were published is a determinative factor in their inclusion. Peer-reviewed journals and periodicals, as well as well-sourced and cited books,

represent most resources referenced throughout the literature review. Data and research from organizations partnered with or publishing on behalf of governmental agencies or other educational entities were deemed to meet similar standards of investigative authority. Data from the National Student Clearinghouse and Department of Education provide opportunities to reference updated statistics relevant to the foundational topics of this analysis. However, websites and online periodicals, including the Chronicle of Higher Education and Inside Higher Ed, typically do not meet the standards necessary to be included in or cross-referenced within academic, peer-reviewed literature.

Justifications for Exclusion

Resources were excluded if they addressed research conducted outside of the United States system of higher education. Publications that reference education systems outside of the United States might not reflect an analogous postsecondary system that is sufficiently comparable to the American secondary and postsecondary systems, including disparities between American community college and university systems. Students outside of the United States might matriculate through a substantially different secondary school system, thus pre-collegiate interventions or preparation programs might not correlate to the bridge programs and remedial courses discussed in this analysis.

Likewise, students outside of the United States, particularly the underrepresented and low-income students included within the scope of postsecondary unpreparedness, might experience dramatically different socioeconomic backgrounds; their academic and social preparations are not comparable with African American, Hispanic, other non-White minority students, or low-income students who are designated as academically underprepared.

Though dissertations serve as resourcing materials, they were excluded from references and citations based on similar considerations given to referenced works from authoritative publishing bodies. Materials distributed by organizations not affiliated with or publishing in conjunction with research agencies, government bodies, or educational institutions were excluded based on similar concerns of established authority and the likelihood of cross-referencing among numerous researchers and investigators. Some cited research, such as Corequisite Remediation: Spanning the Completion Divide by Complete College America (n.d.), was developed with the participation of relevant authoritative bodies, such as the Tennessee Board of Regents and the University System of Georgia.

Theoretical Framework

Concerns of student preparedness, retention, and successful matriculation can be contextualized and examined through the prism of several student development theories that provide theoretical frameworks for how students engage with academia. Models of student change while enrolled in postsecondary institutions vary from developmental theories, which focus on individual growth through intrapersonal stages, to college impact theories that alternatively examine the changes attributed to institutional effects (Pascarella & Terenzini, 2005). Two such foundational college impact theories include Tinto's (1988) theory of student departure and Astin's (1985) theory of involvement. College impact models suggest that increased interactions between faculty and students facilitate greater academic engagement and resultant gains in successful outcomes (Kim & Lundberg, 2016).

College impact theories or models from Astin and Tinto form the basis for several elements of college bridge programs as these programs can expose students to college activities, academic remediation, and cohort- or community-building. Students are often unaware of how to

seek help when they first enroll in college, and early access to faculty interactions and early opportunities for engagement can provide compensatory opportunities for students with a lack of experience with the postsecondary environment (Gasiewski et al., 2012).

Theory of Student Departure

Tinto's theory of student departure is a foundational model of college impact that describes student persistence in the context of varying degrees of students' commitments to postsecondary institutions relative to their obligations to other personal stakeholders, such as family, friends, and other activities (Pascarella & Terenzini, 2005). Tinto's theory centers on the concept that a student's integration into the college determines persistence and dropout decisions and that students integrate by separating from past communities, transitioning between communities, and incorporating into the new communities of their institution (Tinto, 1988). According to Braxton (2019), Tinto's theory posits that students' decisions to exit postsecondary enrollment hinge largely on their academic and social integration into the community of the college and their classroom environments.

Low rates of student persistence are indicative of markers of student success beyond graduation, including the attainment of general education, academic competence, cognitive skills, opportunities for employment, and other achievements (Braxton et al., 2014). The inability of institutions to successfully retain students represents a loss of myriad benefits beyond the conferring of a degree, and the attrition resulting from the loss of continuous enrollment likewise drains institutional resources and time that could be otherwise directed elsewhere.

Theory of Involvement

Astin's theory of involvement has provided important precursors and foundations for a significant body of research related to student engagement and development. Astin's theory of

student involvement is focused on the motivation and participation output of students rather than institutional inputs such as academic resources and techniques (Astin, 1999). According to Astin (1999, p. 528), student involvement relates to "the quantity and quality of the physical and psychological energy that students invest in the college experience," and any institutional efforts and resources can be evaluated based on the degree to which they successfully leverage students' attention and time toward involvement in college activities.

Astin's theory posits that students are more likely to be retained if they are more involved in their academic endeavors and in college life, thus illustrating a link between student persistence and the success at which colleges encourage student involvement in academic and institutional provisions (Seidman, 2012). Rather than providing an "elaborate schemata" to inform the design of complex student engagement protocols, Astin's theory posits simply that students learn by becoming involved in college and that colleges are in competition with external responsibilities that detract from time dedicated to postsecondary activities (Astin, 1985, p. 36). Though Astin's conception does not necessary constitute a formal theory, student involvement is a useful contextualization of the psychological and sociological interactions of student development and the inputs that colleges can contribute to affect positive impact (Pascarella & Terenzini, 2005).

Relationship to College Bridge Programs

Elements of Tinto and Astin's models, including student involvement and persistence, are essential aspects of introductory college experiences, and bridge programs focus on preparation and enculturation. Bridge programs that provide college-level coursework and increase students' involvement on campus should result in improved outcomes for participants (Wachen et al., 2018). In short, college bridge programs are an opportunity to integrate students into an

academic community, as Tinto's model suggests, as well as to provide another institutional resource in which students can invest time, as suggested by Astin's theory of involvement (Pascarella & Terenzini, 2005).

Like the purposes of bridge programs that precede incoming students' first semester in college, Tinto's theory of student persistence and decisions to abandon postsecondary enrollment focus heavily on the concept that the successful completion of the first year of enrollment is of disproportionate importance in the progression toward the complete of a full degree (Tinto, 1988). Features of Tinto's theory correspond to the elements or purposes of bridge programs, specifically the goal of retention, and include the introduction of students to the college experience, familiarization with college curriculum and expectations, association with faculty, and integration into communities or cohorts (Seidman, 2012). Bridge programs that precede enrollment can address academic and social deficits that some underrepresented or underprepared students might experience. Indeed, Tinto's model calls for the "front-loading of institutional action" to counter early student departure (Tinto, 1988, p. 451).

According to Quiroz and Garza (2018), Tinto's model has been a foundational influence on the study of student persistence and students' decisions to dropout, and their examination of the retention and academic performance outcomes of a summer bridge program focused on predominantly Hispanic students in which participants across several cohorts exhibited higher gatekeeper course pass rates and fall-to-fall retention rates. The researchers identified several successful elements of the bridge program that reflect the academic and social integration espoused by Tinto's model, including academic preparation, emotional quotient, college experience and faculty interaction, and leadership development (Quiroz & Garza, 2018).

Astin's theory of involvement contextualizes the bridge program experience by providing stakeholders with an opportunity to engage underrepresented, underprepared, or inexperienced students early and inculcate a sense of involvement and early exposure to faculty interactions. Pascarella and Terenzini (2005) note that bridge programs typically acclimate students to campus, introduce peer groups, provide students with study skills and academic training, and provide opportunities for introductions to faculty. Murphy et al. (2010) found that underrepresented participants in a bridge program with peer mentors resulted in increased graduation rates among underrepresented students, though African American retention decreased. Wachen et al. (2018) likewise cited peer mentors, among other support services, as a focus of a summer bridge program that produced increases in participant persistence and graduation.

In addition to improving persistence, bridge programs can introduce students to the expectations of college instructors. Astin's theory of involvement identifies student-faculty interaction as the strongest type of involvement related to student satisfaction with the college experience (Astin, 1999). Kim and Lundberg (2016) found that student-faculty interaction is an important influencer for positive gains in academic self-challenge and, less so, for sense of belonging. However, while these interactions can benefit cognitive development among students and thus advantage underprepared students, underrepresented students are less likely to have access to such faculty interactions (Kim & Lundberg, 2016). Thus, college bridge programs that include exposure to faculty interactions and academic skills development can provide positive motivational gains for underrepresented, underprepared, or otherwise at-risk student populations as predicted by Astin's model.

Higher Education Access and Retention

Access to community colleges and non-selective universities is an integral component necessary for a model of egalitarian higher education. Community colleges enroll a disproportionate number of at-risk students, including two-thirds of whom are food insecure, half of whom are housing insecure, and between 13% to 14% of whom are homeless (Goldrick-Rab et al., 2017). Similarly, community college enrollment of non-White students increased from 6% in 1965 to 38% by 2009 (Mullin, 2012). Expanded access to higher education has also resulted in improved success rates for underrepresented students. Black male graduation rates improved from 28% to 35% and Black female graduation rates increased from 34% to 46% between 1991 and 2006 (Bir & Myrick, 2015). However, universities and other selective colleges can establish minimum qualifications for entry, including high school GPAs, nationally standardized test scores, and relatively high tuition rates that restrict entry, as well as institutional placement tests and mandatory remedial courses that serve as hidden barriers to access.

Despite the open access mission of community colleges and other non-selective institutions and the shared benefits of modern higher education, variations in student preparedness and college readiness present barriers for individual students and broader student populations. According to the National Center for Education Statistics (as cited in Tierney & Sablan, 2014), fewer than 60% of four-year college students will graduate within six years and 40% of four-year college students take at least one remedial course. Low rates of college readiness present access and persistence issues for higher education because remedial coursework is an indicator of a lower probability of graduation, and underrepresented students are disproportionately affected by a lack of preparedness (Tierney & Sablan, 2014). The placement test process exists as a determinative factor in higher education accessibility even at open access and non-selection institutions.

Placement Testing

College placement tests are standards by which students are assessed as prepared or not for college-level curriculum and coursework. Such examinations can vary from national standardized tests, such as the ACT or SAT, or institutional assessments required as an onboarding tool during the admissions process. Students determined to be underprepared for college-level courses typically enroll in remedial or developmental courses before they can progress to advanced curriculum (Barnett & Reddy, 2017).

The purpose of placement testing, even for students seeking entry to otherwise open access colleges, is the assurance that students are prepared for the rigor of college-level coursework. Placement testing gained prominence during the 1980s as colleges and state policymakers responded to high dropout rates with entry exams designed to match students' aspirations and abilities with comparable programs of study (Cohen et al., 2014). Unless allowed an exception by virtue of previously completed college courses or satisfactory scores on national standardized tests such as the ACT or SAT, as many as 92% of two-year colleges administer placement tests for entering students (Scott-Clayton, 2012). Approximately 55% of community college freshmen are placed in developmental courses, and fewer than half of developmental students persist to degree completion (Cullinan et al., 2019).

The efficacy of placement testing has been analyzed by researchers to determine whether placement tests are accurate assessments of students' capacities to succeed in college curriculum, or if other measurements exist that might better prepare students for college-level coursework. However, the accuracy of placement assessments alone varies relative to students' academic capacity to progress through credit-bearing college curriculum varies. For instance, MacGregor et al. (2017) analyzed COMPASS placement test data for 6,117 new community college students who enrolled in an online course and determined that placement test results for reading and

writing accurately classified students in appropriate course levels. Fain (as cited in Cohen et al., 2014) found that when Long Beach City College assigned 53% of one thousand remedial-level incoming freshmen to college English based on their high school grade point averages, 62% of the students passed the class, similar to the college's typical pass rate for non-remedial students.

Students who perform poorly on non-standardized, high-stakes placement tests can be incorrectly relegated to developmental coursework that interferes with their natural academic progression. Cutoff scores that determine whether students are assigned to remedial courses fail to clearly delineate academically prepared students from those in need of remedial support because variations in students' capacities exist at these thresholds (Scott-Clayton & Rodriguez, 2015). Rodriguez et al. (2016) found that different California colleges rely on widely disparate benchmark scores to determine college readiness despite using the same Accuplacer placement test. Mejia et al. (2016) found that 80% of California community college students enroll in at least one developmental program. Though these results reflect placement test results from one state, California enrolls 20% of the country's total community college population (Rodriguez et al., 2016). The inconsistency of placement test interpretation and utilization brings into question the efficacy of these efforts.

Likewise, students who can outperform a single high-stakes placement test can be misplaced in coursework for which they are unprepared. Placement testing can result in overplacement, wherein students are assigned to college-level classes that they subsequently fail, or they can be underplaced, wherein they test at remedial-level but would successfully complete college-level curriculum (Cullinan et al., 2019; Scott-Clayton, 2012). Placement errors based on faulty placement test design or anomalous student test performances are detrimental to access,

persistence, and completion even as this process is intended to provide students with curriculum that will make them more likely to succeed in their intended programs of study.

Each type of placement error can hinder students' relative progressions through their degree programs, either by a lack of academic support or a misdiagnosis that artificially prolongs students' matriculation. Based on an analysis of COMPASS placement test scores of 42,000 first-time freshmen, Scott-Clayton (2012) found that Math placement scores were significantly more accurate than English placement scores and could substantially reduce severe placement errors and substantially increase success rates for students placed directly into college-level coursework. Because the stakes of placement testing are so significant for subsequent student success and because placement tests are more likely to predict which students can succeed rather than which students need support, Scott-Clayton posited that direct college-level placement for some developmental students or the use of high school performance would result in improved student outcomes relative to standalone placement tests. Similarly, Cohen et al. (2014) described inconsistencies with recommended and mandatory remediation based on placement test scores that result in students receiving curriculum unaligned with their capacities.

Inaccuracies in placement test results can impede students' otherwise natural progression through postsecondary education if they are misdiagnosed as under- or overprepared for college curriculum. In one instance, Latino rights organizations filed a lawsuit in 1988 against a California college based on discrimination in access, and California and other states subsequently mandate validation of placement test scores relative to student performance (Cohen et al., 2014). Scott-Clayton et al. (2014) discovered that high school transcript data resulted in fewer severe overplacement and underplacement mistakes than placement test results, and that

combined results from high school transcripts and placement tests produce even more accuracy regarding college-level or remedial placement.

The brevity or statistical noise attributed to placement tests might contribute to their lack of dependability and subsequent difficulty in delineating remedial cutoff points, and high school performance captures a longer duration of academic performance and indicates dimensions of college readiness, including student effort and motivation (Scott-Clayton et al., 2014). Regardless of the prominence or causes of placement errors, the frequency of remediation necessitates an examination of developmental curriculum and the student populations most likely to begin postsecondary education in remedial courses.

Developmental Coursework

The most common strategy to resolve deficiencies of college-readiness has been remedial and developmental coursework. As defined by Stewart et al. (2015), developmental courses are intended to compensate for a lack of reading, writing, and mathematics skills necessary to succeed in college coursework. Developmental coursework is intended to support preparedness for college-level courses, though this type of remediation can also be viewed as an obstacle that prevents students from progressing through their program of study (Edgecombe & Bickerstaff, 2018). For students whose secondary educations were not sufficiently preparatory for the expectations of higher education, developmental classes can provide supplementary skills and knowledge. Developmental coursework in reading, writing, and math can be offered in the first semester or first academic year of developmental-level students' enrollment (McGlynn, 2012). Remediation, therefore, serves as a precursor for intermediate and advanced college curriculum. According to Pratt (2017), 68% of students enrolled at two-year public colleges between 2003 and 2009 took at least one remedial class. Another estimate indicates that more than 60% of two-

year college students are enrolled in remedial courses (Wilson & Lowry, 2017). That remediation is so common among college students emphasizes the importance of ensuring that developmental classes, if necessary, benefit students' ability to attend college.

Outcomes of Developmental Coursework. Remedial or developmental coursework is intended to benefit students who might otherwise struggle to complete college-level curriculum. However, questions remain regarding what qualifies an individual study as prepared to undertake college-level curriculum (Edgecombe & Bickerstaff, 2018). Attempts have been made in the past to determine the effectiveness of developmental coursework. Pascarella and Terenzini (2005) performed a meta-analysis of research on remediation and determined that academic intervention programs are at least modestly effective in preparing students academically and improving persistence between the first and second semesters and from the first to second year in both two-year and four-year institutions. Although programmatic inconsistencies might contribute to variations in the results of remediation analyses, hundreds of studies indicate that student placement procedures are valid and that developmental classes result in improved reading and writing skills (Cohen et al., 2014).

However, analyses of remediation have not provided conclusive results. Scott-Clayton and Rodriguez (2015) examined data from a large urban community college system and determined that developmental courses have little effect on students' skills and instead divert students away from the college-level courses. According to Boatman and Long (2018), the effects of developmental coursework appear to have differential effects based on students' relative levels of academic preparedness. Students on the margin of college level Math coursework who opt to enroll in higher levels of developmental Math experience diminished credit accumulation over the course of their enrollment relative to students who require more

basic levels of Math remediation (Boatman & Long, 2018). Boatman and Long (2018, p. 53) similarly found similar patterns in English remediation with results that indicated that "students who were assigned two levels below college-level English were more likely to persist than similar students who were assigned only one level below the college thresholds and by a wide margin (17.7 percentage points)." Moreover, developmental coursework can serve to syphon students' engagement and time from a typical progression toward degree completion, thus countering the benefits predicted by Astin's theory of involvement.

Problems of Mandatory Developmental Coursework. The open access nature of postsecondary education is diminished by some students' lack of preparation to meet the minimal academic standards of entry as defined by placement tests. As many as 20 to 60% of postsecondary students place at remedial levels, and remediation occurs at a higher rate for community college students relative to their university-bound peers (Wathington et al., 2016). Remediation through developmental coursework is even more acute at community colleges, and only 40% of academically underprepared community college students persist and complete college-level Math courses necessary to earn a credential (Ngo & Kosiewicz, 2017).

The ability to maintain satisfactory academic progression through a postsecondary program of study is a basic component of higher education enrollment. The design of developmental coursework and the cause of mandated remediation presents debilitating problems for students and institutions. According to Logue et al. (2017), students' persistence and matriculation is affected by remediation that encumbers students in developmental courses that do not result in college credits. Based on an analysis of 3,213 first-time freshmen at a large public university, Stewart et al. (2015) found that only 60.5% of remedial students persisted five or more semesters relative to 73.2% of non-remedial students who persisted for five or more

semesters. This disparity suggests that developmental coursework might fail to provide adequate skills and preparation to enable academically underprepared students for the rigors of later college curriculum.

One of the more salient problems for students required to complete developmental classes is the delay in matriculation and degree completion. Developmental courses typically do not count as credit-bearing courses for the purpose of degree attainment (McGlynn, 2012; Scott-Clayton, 2012). Further, students who require remediation in multiple subject areas can have their progress delayed as they accumulate non-credit developmental coursework, leading to increased drop-out rates (Wathington et al., 2016). The lack of credit-bearing status of developmental or remedial coursework and the need for some students to accumulate these courses in several subjects serve as compounded barriers to persistence.

Underprepared college students who are required to enroll in developmental courses incur additional financial obligations for those classes. For students dependent upon federal, state, and institutional financial aid, developmental coursework uses available funds and limits students' duration of eligibility. Pratt (2017) estimated that students spend approximately $7 billion each year on developmental college coursework, and the rate of remediation increases as students' income levels decrease. As such, students most in need of financial support are also more likely to be enrolled in classes that do not provide college credits that contribute to a degree. The disproportional reliance on financial aid and loans by students who are more likely to require remediation contributes to a 20% loan default rate for community college students that is more than twice the rate of their university peers (Pratt, 2017).

Additionally, states subsidize higher education, and as such taxpayers are in part responsible for financing remedial efforts for students designated as underprepared (Kallison &

Stader, 2012). The total costs of remedial coursework within the community college sector might be nearly $4 billion (Scott-Clayton & Rodriguez, 2015). The combined cost of remedial education for students and states is more than $1.3 billion each year (Logue et al., 2017). Cohen et al. (2014) predicted that developmental curriculum and remedial programming will account for one-third of the instructional budgets at community colleges, with higher allocations required for colleges that require placement testing and remediation and for colleges in areas with higher rates of college-going, immigration, and marginally literate student populations.

Students already at risk of other barriers and limitations to access and persistence are disproportionately affected by the need to complete developmental and remedial courses. Included in the 40% estimate of entering students subjected to remediation, 52% of low-income students and 62% of minority students are relegated to developmental coursework (Kodama et al., 2018). Socioeconomic and demographic indicators therefore highlight uneven rates of barriers to access and retention for students already defined by other at-risk characteristics.

Placement and Remediation as Barriers. The use of placement testing and remediation are contrary to the open access concept of higher education when underprepared students are unable to enroll, persist, and matriculate at comparable levels relative to their academically and socially prepared peers. Non-selective admissions policies at open access institutions require placement tests that limit individual students' opportunities to take credit-bearing courses (Pratt, 2017). The effects of developmental placement disproportionately affect underrepresented students. Black, Hispanic, and low-income students, as well as students enrolled at nonselective two-year colleges, are more likely to experience a readiness gap that results in their placement in courses that do not bear college credit (Logue et al., 2017).

According to Saidy (2018), most standardized tests used for placement, including the SAT and ACT, are more likely to privilege White students and students from middle- and higher-income backgrounds, and that such tests can result in segregated, homogenous classroom populations. Geiser (2015) found that race and ethnicity are the most salient and strongest predictors of test score differences on standardized test results, and that these variables exceed family income and parental education in explaining test score disparities. Based on existing demographic and socioeconomic characteristics, placement testing results in predictable disparities in the assignment of remedial or developmental coursework that decelerates matriculation for many underrepresented students.

According to Cohen et al. (2014), students who could otherwise succeed in college but are relegated to enrolling in developmental coursework based on placement assessments are limited in their opportunities to pursue higher education. Instead, they enroll in college courses that often do not provide credits that contribute toward their programs of study and graduation. The prevalence of high-stakes placement exams that determine whether students are granted access to college-level curriculum or directed to developmental coursework reached 92% of all community colleges by the beginning of the 21st century, thus ensuring that placement testing and remediation would serve as tacit access barriers for almost all students seeking postsecondary education through two-year colleges (Cohen et al., 2014).

Persistence and Retention

Student persistence and college retention are essential, complementary aspects of the goal of matriculation and degree completion. According to Tinto (2017), persistence describes students' willingness and capacity to remain enrolled and complete their postsecondary education, and colleges and universities should focus on efforts to influence students to enroll,

persist, and ultimately earn tertiary degrees. Students' learned self-perceptions about their academic abilities and purposes regarding higher education are foundational aspects of persistence and retention. Attributes of students' personalities, such as self-efficacy, sense of belonging, and their belief in the value of what they learn and gain through postsecondary enrollment are central tenants of their motivation to persist through matriculation (Tinto, 2017). As such, attempts to address retention should target students' motivational factors rather than institutional infrastructure or faculty and personnel preferences.

Historical and current research on student persistence and institutional retention of enrollment focuses largely on the contextual fit between students and the environment of their educational institution. According to Pascarella and Terenzini (1983), student attributes such as race, secondary school experiences, academic ability, and family background inform individuals' commitment to their respective institutions and their commitment to graduation. Likewise, academic environments that promote learning and improvement in math and science have promoted better performance among all students with the greatest effects benefiting underrepresented groups (Malcom & Feder, 2016). Tinto and Pascarella and Terenzini emphasize inherent or developed background characteristics as influencers and motivators for student performance, and institutional inputs into the ways in which students engage with curriculum, faculty, other students, and the physical space of campus are crucial to ensure persistence for students with disadvantages in academic development, inclusion, or self-efficacy.

Potential resolutions to issues that hinder or prevent student persistence include state-level financial aid programs. Research indicates that students can reduce work hours and borrow fewer loans when free grant aid is increased (Evans & Nguyen, 2019). Need-based state aid programs would supplement federal aid resources based on student income or need, while merit-

based state aid programs would require that students meet certain achievement benchmarks to achieve eligibility, including metrics such as GPA or standardized test scores. However, analyses of specific need- and merit-based financial aid programs have demonstrated mixed results regarding the effects of such programs have on student persistence and a causal relationship between financial aid eligibility and degree completion has not been established (Chen & St. John, 2011; Malcom & Feder, 2016). Regardless of the effects of specific financial aid programs, students who have higher rates of financial need tend to have lower rates of degree completion than other students, and students can fail to establish or later lose eligibility due to factors including first-generation status, excessive remedial or transfer courses, and lower academic achievement in high school (Malcom & Feder, 2016).

In addition to the purpose and design of merit- and need-based financial aid programs and their effects on student access and persistence, federal loans serve a complementary purpose with mixed outcomes. According to McKinney and Burridge (2015), federal loans were negative influences on the likelihood of persistence among community college students, and the possible consequences of loan borrowing are worse for low-income and underrepresented minority students, the majority of whom are enrolled in community colleges. Though loans can facilitate access to higher education for low-income students who would otherwise be unable to afford even modestly priced colleges, the aggregation of loans can prove unsustainable for persistence and graduation. McKinney and Burridge (2015) found that borrowers had significantly higher odds of discontinuation of enrollment relative to non-borrowers. The consequences of continued reliance on loans at community colleges indicates that these populations of students experience socioeconomic disadvantages compounded by the negative consequences of sustained reliance

on federal loan borrowing. Students who must rely on loans and complete remedial coursework are burdened by two disadvantages that hinder matriculation and degree completion.

Persistence among different populations of students remains uneven and creates disparities in completion, degree attainment, and subsequent labor market benefits. According to data from the National Student Clearinghouse (2019), 2.6 million out of 3.5 million students, or 73.8%, who enrolled in any college type for the first time in fall 2017 persisted into fall 2018, and this rate represents a 2.2% increase relative to the fall 2009 cohort. However, within this first-time student cohort, disparities exist among students of differential race and ethnicity. Black or African American students in the fall 2017 cohort persisted at just 66.2% compared to Asian, White, and Hispanic students who persisted at rates of 84.7%, 78.1%, and 70.3% respectively (National Student Clearinghouse, 2019).

Chen and St. John (2011) analyzed persistence rates among differential racial and ethnic groups of students relative to state-based financial aid programs and found substantial gaps in persistence rates for low-socioeconomic students compared to high-socioeconomic status students. Students with lower incomes have, by definition, fewer resources available to maintain postsecondary enrollment. Thus, underrepresented students defined by their low-income status are less likely to persist when tuition rates are elevated and need-based state aid is low (Chen & St. John, 2011). In addition to lower overall persistence and completion for underrepresented students, Black or African American, Hispanic or Latino, American Indian, and Alaskan Native students experience disparate degree completion rates within programs of study associated with science, technology, engineering, and mathematics (STEM) (Estrada et al., 2016). Such disparities were exacerbated by COVID-19 as higher education institutions transitioned to online learning to the possible exclusion of almost 30% of students who did not have access to the

internet (Gurukkal, 2020). Likewise, the relative lack of STEM degree attainment for underrepresented students narrows the pipeline through which these students would obtain STEM-related careers.

Ethnic minority students, non-traditional adult learners, first-generation, and low-income students who can be designated as underrepresented are naturally more susceptible to issues related to Astin's involvement model and Tinto's student departure model. Underrepresented students are less likely to have family and peer support groups prior to college enrollment, and relationships between student families and school counselors is a valuable access strategy for low-income underrepresented students (Holcomb-McCoy, 2010). An expansion of support mechanisms throughout the college pipeline can inculcate postsecondary involvement and an investment of time from students thus extending their enrollment (Seidman, 2012). A separation from distractive elements of past communities and an integration into the college community through rewarding interactions with institutional stakeholders is a key feature of Tinto's departure model, and inculcation of integrative interactions presumably results in greater levels of persistence (Pascarella & Terenzini, 2005). Underrepresented students whose precollegiate experiences are not conducive to the academic and social norms of higher education can benefit from strategies and investments that confer belonging and elicit time commitments to the college community and postsecondary expectations in general, though placement testing and remediation are not necessarily aligned with this purpose.

Underrepresented Students in Higher Education

Students whose enrollment, persistence, and graduation rates are proportionately less than that of their peers are understood as underrepresented in postsecondary analyses. However, national demographic trends suggest a shift in proportionality among non-White minority groups

both within the general population as well as among potential postsecondary enrollees, and such trends are a continuation of recent changes. Whereas White student postsecondary enrollment decreased from 77% in 1990 to 57% in 2012, the enrollment rates of Black and Hispanic students increased from 12% to 15% and from 6% to 16% respectively (Malcom & Feder, 2016). Projections indicate that by 2030 the number of White high school graduates is expected to decline by 14% even as the overall rate of high school completion increases within the general population (Bransberger & Michelau, 2016). Shifts in population dynamics and improved rates of high school completion increase the total population of non-White minority students who are currently underrepresented in higher education. In fact, Bransberger and Michelau (2016) predict that non-White students will represent 51% of graduates from public secondary schools by 2026, thus altering the postsecondary enrollment paradigm in terms of the volume of students currently considered underrepresented.

Despite recent gains and a contemporary acceleration in minority representation at the access point of higher education, Hispanic and African American students continue to show underrepresentation in several key measurements of postsecondary participation. Though underrepresented students experienced enrollment gains of 29.6% to 45.2% in undergraduate programs and 20.8% to 32% in graduate programs between 1996 and 2016, significant disparities exist between White, second-generation college students and their underrepresented peers (Espinosa et al., 2019). Non-White minority students and first-generation students do not benefit from the same levels of access to all postsecondary institution types, nor are they able to matriculate at the same rate as or with the same debt burden as their White counterparts.

Similar disparities exist in persistence rates, though frameworks such as Astin's theory of involvement and Tinto's theory of student departure are the bases for interventions that should

result in improvements to postsecondary outcomes, including persistence (Wachen et al., 2018). Though enrollment rates have increased in recent years, minority students are often first-generation students and have fewer family, friends, and mentors who are experienced with postsecondary processes and expectations (Vega & Moore III, 2012).

Enrollment Rates of Underrepresented Students

Considerable differences exist between students of different backgrounds both in higher education in general as well as throughout types of postsecondary institutions. Such differences suggest different access points depending on racial and ethnic backgrounds and indicate an overreliance of some underrepresented populations on public two-year institutions for postsecondary enrollment. Historically, White students are more likely to enroll at four-year, private, and nonprofit colleges and universities, whereas Black and Hispanic students are overrepresented in two-year and proprietary institutions (Renn & Reason, 2013). However, according to Grawe (2018), demographic changes, including differences in fertility rates and immigration and interstate migration, will result in shifts in higher education from traditional college-going populations to underrepresented populations. By 2032, the projected rate of increase in high school matriculation among Hispanic and Asian and Pacific Island students is expected to increase by over 15% in almost every state, with accompanying decreases in non-Hispanic White students and non-Hispanic Black students (Grawe, 2018). This divergence among populations in the postsecondary pipeline represents a departure from what has been considered a traditional rate of enrollment among demographic groups, and this change emphasizes the need for institutions to intervene and amend disparities in retention and completion that currently exist between groups of students whose identities and success rates are defined by ethnicity, socioeconomic status, or academic preparation.

Like the demographic shifts that influence postsecondary attendance among racial groups, the cost of higher education can affect enrollment decisions for low-income and academically underprepared students. Increases in tuition costs disproportionately diminish enrollment at public institutions among students from lower socioeconomic households and lower-performing students who are comprised of 20% Black and 19% Hispanic students relative to non-minority White students occupying an overwhelming majority of elite students (Hemelt & Marcotte, 2016). A bifurcation of enrollment choices between better-performing or higher-income students and lower-performing or lower-income students presents inequities in access, as well as resultant inequities in programmatic offerings at different institution types necessary to intervene in retention gaps. Hemelt and Marcotte (2016) point to enrollment increases at the least selective public institutions in states that experienced tuition and cost increases from 1992 to 2004, a trend that can exacerbate postsecondary selection deficits for students without the academic, socioeconomic, or intergenerational benefits of traditional students.

Community colleges provide the most accessible transition to higher education for many underrepresented student populations because of their open access admissions policies, relatively low tuition rates, and commutability. Community colleges serve many adult, minority, first-generation, and low-income students who might otherwise be restricted from postsecondary access (Ma & Baum, 2016). According to the American Association of Community Colleges (2022), the demographic breakdown of community college students includes 27% Hispanic, 12% Black, 44% White, and 7% Asian or Pacific Islander. Underrepresented minority students represent 41% of all community college enrollees, including 14% African American and 15% Hispanic or Latino (Baime & Baum, 2016). Though enrollment at for-profit sector colleges declined by 18% between fall 2015 and fall 2017, 10% of Black undergraduate students attended

such institutions and represented more than twice the share of any other ethnicity in that segment of postsecondary institutions (Ma et al., 2019).

Enrollment at Community Colleges

Community colleges' open access policies, locations, and comparatively low tuition rates make these institutions essential gateways for minority, first-generation, low-income, and adult students (Espinosa et al., 2019; Ma & Baum, 2016). Students who initially enroll at the community college level are particularly susceptible to the mechanisms of attrition and the discontinuation of enrollment prior to degree completion. Remedial courses and other barriers can leave roughly half of community colleges, ethnic minorities among them, without a credential (Espinosa et al., 2019). Specifically, students who begin at community colleges are less likely to complete bachelor's degrees than students who begin at universities, and the differential success rates between these populations disadvantages community college students as higher rates of postsecondary attainment typically result in higher lifetime earnings (Monaghan & Attewell, 2015). According to the National Student Clearinghouse (2019), eight-year completion rates increased by 1% and 1.3% among public and private four-year students but declined among public two-year students by 2.7%. This disparate rate of persistence between students at different institution types is likely attributable to a confluence of students' family and socioeconomic backgrounds, institutional support mechanisms, and academic preparedness.

Graduation rates among community college students are underreported by the Department of Education, and further analysis is needed to understand disparities among different demographic groups, but many community college students fail to complete any kind of credential (Ma & Baum, 2016). Monaghan and Attewell (2015) identified three commonly understood causes of differential baccalaureate attainment rates between students who begin at

community colleges and students who begin at universities, including the lack of transfer among community college students with 60 or more earned hours, loss of transfer credits among successful community college transfers, and remedial coursework. Hlinka (2017) found through qualitative study that community college students' decision-making processes related to persistence are affected by community and family valuation of college graduation, barriers associated with family obligations, and difficulties adapting to the cognitive demands of postsecondary curriculum. Additional analysis of institutional interventions intended to improve student motivation and prevent departure can ameliorate performance gaps among community college students.

First-Generation Students

First-generation students, a population that represents one-third of all college students in the United States, are those whose parents did not attend college (Skomsvold, 2015). First-generation students from Black, Hispanic, and Native American families are less likely to transition from secondary to postsecondary institutions compared to their White peers (McCoy, 2014). First-generation status is simultaneously underrepresented within higher education and compounded by other indicators of underrepresentation. The lack of college-going experience within a student's family negatively impacts first-generation students even if they perform well academically (Cataldi et al., 2018). Other social and demographic attributes that contribute to difficulties in persistence and completion are commonly associated with first-generation students, including factors such as delayed college enrollment, enrolling part-time, working fulltime, supporting dependents, or being age 24 or older (McCallen & Johnson, 2019). First-generation students are, therefore, both more likely to be represented by demographic attributes

that are associated with lower postsecondary participation and more likely to be affected by these compounded characteristics.

Intergenerational college experience influences the enrollment tenure and graduation time of college students. According to Ma et al. (2019), nearly two out of three students whose parents possessed at least a bachelor's degree graduated within five years of their initial enrollment compared to fewer than half of students whose parents did not possess a bachelor's degree or more. Relatedly, research conducted by McCallen and Johnson (2019) found that while first-generation students produce differential rates of adaptation to college enrollment, they all experienced similar disadvantages because of their families' limited educational history and institutional support mechanisms to address such deficits.

First-generation students also differ from students whose parents graduated college in their college-based interactions and expectations. First-generation students are differentiated from other students and defined primarily by an absence of postsecondary experience within their families, and familial relationships can both motivate and detract from college integration (Cunningham, 2019). Murphy and Hicks (2006) found that students whose parents had no college experience were less likely to anticipate socializing with friends and other students and more likely to expect to graduate from their current institution rather than transfer. Longwell-Grice and Longwell-Grice (2008) found that first-generation, working-class students were intimidated by seeking interactions with faculty, and this diminished retention among this population. Faculty interactions and the incorporation of students into the postsecondary community are important elements of Tinto's theory of student departure, and interventions such as "coming out" ceremonies in which student and faculty bonds are made through the recognition of student persistence through the first grading period are important, if ceremonial,

steps in the community-building that can address the reluctance and intimidation experienced by some students (Tinto, 1988, p. 452).

Performance and Outcomes of Underrepresented Students

Students from underrepresented backgrounds, including African American, Hispanic, and low-income students, are disproportionately encumbered by developmental coursework relative to their White peers. According to data from Complete College America (n.d.), among 42% of all postsecondary students who require some form of remediation, 56% are African American, 45% are Hispanic, and 55% are Pell Grant recipients. The additional burden of developmental coursework presents as an intractable barrier for some students and diminishes the equitable availability of higher education.

Underrepresented student groups continue to experience disparate benefits and higher rates of barriers than traditional students, and often underrepresented students face multiple difficulties that inhibit matriculation. According to Gershenfeld et al. (2016), students' race and socioeconomic status are significant contributors to college graduation rates as students of color and low-income students face cultural, campus climate, and academic deficiencies not experienced by traditional students. Hispanic men and women and American Indian or Alaskan Native men exhibit the lowest levels of educational attainment as of 2017 despite increases in overall national population representation and racial parity within higher education (Espinosa et al., 2019).

In addition to differences in graduation rates among different student groups, disparities exist in the matriculation time for students who can continue enrollment and persist until graduation. Only 53% of Hispanic students and 46% of African American students complete a bachelor's degree in five years or less compared to rates of 64% of Asian students and 62% of

White students (Ma et al., 2019). Underrepresented students might be more susceptible to predictors of graduation than White students. Gershenfeld et al. (2016) found that underrepresented minority students with a first-semester GPA of 2.33 or lower were approximately half as likely to graduate as referenced comparisons, and that low-income White students likewise had significantly lower graduation rates than their peers.

Despite recent focus on underrepresented students' participation rates in higher education, gaps in research exist. Tinto's model of student departure fails to account for various social and psychological explanations for underrepresented student retention (French, 2017). Tinto's model contextualizes how students are affected by various background and life characteristics, but it does not delineate the novel influences experienced by underrepresented students and thus lacks in the provision of specific institutional interventions (French, 2017).

Differences in the rates of enrollment and completion for underrepresented students are especially prevalent in programs of study related to science, technology, engineering, and mathematics. According to Mau (2016), non-Asian underrepresented students are both less likely to declare a STEM discipline as a program of study and less likely to complete a STEM degree in five years relative to their White peers. Gansemer-Topf et al. (2017) found that White male students were overrepresented within and significantly more likely to be retained in STEM programs compared to their ethnic minority counterparts. Underrepresented, low-income, and first-generation students are significantly less prepared in STEM programs (Bransberger & Michelau, 2016). Though initial interest rates in these disciplines begin equally among all students, different examination scores in gateway STEM courses result in six-year completion rates that decrease from 52% for Asian Americans and 43% for White students to 22%, 29%, and 25% for Black, Hispanic, and Native American students, respectively (Theobald et al., 2020).

Disparities in STEM degree completion are exacerbated by similar enrollment rates in which STEM students disaggregate by race and ethnicity with 16.4% White, 11.5% Black, 14.5% Hispanic, 27.3% Asian, 12.4% American Indian, 15.2% Pacific Islander, and 17.5% two or more races (Skomsvold, 2015). Similarly, though students in the lowest 25th percentile income group make up 15.4% of STEM enrollment relative to STEM enrollment of 17.5% for the highest 25th percentile of students, low-income students have lower completion rates compared to their higher-income peers (Skomsvold, 2015; Theobald et al., 2020).

Value of Higher Education

The importance of postsecondary access, academic preparation, and equitable enrollment rates is demonstrated by the various economic and social benefits of college matriculation. Following the Morrill Act in 1862, the prevalence of postsecondary institutions and students' subsequent access to those institutions consistently expanded for more than a century (Bok, 2013). During this expansionary period, individuals were able to access postsecondary education more readily, and the efficacy of higher education was borne out in higher income rates for participants. The economic benefits of an educated workforce likewise increased during the post-World War II era during this expansion of accessibility. Industries that employ high rates of employees with postsecondary attainment, such as healthcare, financial, education, and government services, now account for 46% of the workforce relative to 28% in 1947 (Carnevale et al., 2016).

One of the overriding and primary purposes of postsecondary participation is the economic value associated with degree attainment, and educational institutions commonly cite these benefits as justifications for college enrollment. In addition to increased income and improved employability, the efficacy of postsecondary access is reflected in other aspects of

individuals' lives, even for students whose participation in higher education is bound within two-year academic programs. The precise labor market value of community college education is not a thoroughly researched topic and can vary based on students' location, enrollment choices, and program pathways (Belfield & Bailey, 2011; Dadgar & Weiss, 2012). However, the economic viability gained by postsecondary enrollment, specifically attendance at community colleges, also includes benefits such as improvements in health status and well-being and reduced rates of criminal activity and incarceration (Belfield & Bailey, 2011). Myriad studies indicate with few exceptions the utility of higher education participation, whether defined as financial, personal, or societal, and the assurance of accessibility for all participants is a necessity to realize these goals.

Financial Effects

The mechanism of upward mobility provided by postsecondary attainment is the anticipated gain in income associated with college attendance and completion. According to Bok (2013), by 2010 the median annual income for adults holding college degrees reached $54,000, whereas adults with only a high school diploma reached $32,600. The financial benefits of higher education received by students and the economic benefits shared by states are not exclusive to baccalaureate degree attainment, thus underscoring the value of community college access for students not academically prepared for college-level curriculum at universities. A year of study in an associate's degree program at a two-year institution provides approximately the equivalent earning potential as a year of study in a bachelor's degree program at a four-year institution, and that the economic and financial contributions of community colleges are comparable to students' incomes at four-year institutions during similar periods of analysis (Bok, 2013).

The value of enrollment in open access community colleges increases when evaluated with the expected long-term financial gains associated with attainment of two-year degrees. Likewise, the intersection of the relative accessibility and subsequent economic benefits of degree attainment, even at incomplete, vocational, or associate's degree levels, is significant for underrepresented students. According to Giani et al. (2019), students' prospects of employability and earnings after departing college are better than the average earnings of their peers who never went beyond high school, and such findings hold true for minority and underrepresented student groups. Similarly, Kim and Tamborini (2019) found that sub-baccalaureate education at all levels, including associate degrees, vocational diplomas or certificates, and college dropouts, provides greater annual and cumulative earnings based on analyses of Social Security Administration and the 2004 and 2008 Survey of Income and Program Participation data.

In addition to the benefits of degree completion, even partial postsecondary education can provide substantial economic gains for students. Persistent enrollment in higher education can result in improved salaries, employment rates, working conditions, and professional mobility (Andrade et al., 2020). The median twenty-year earnings for men with some college or an associate's degree is 15% and 24% higher than earnings of high school graduates, and women benefited from similar differential income rates at each educational attainment stage, albeit with lower overall incomes than their male peers (Kim & Tamborini, 2019). Thus, even college enrollment that does not result in degree attainment can provide improved rates of income and additional labor market entry points for all participants, including historically underrepresented students. Though exceeded by the value of postsecondary matriculation, the value of college access can be quantified and reflected by higher lifetime earnings. The relative value provided by community college degrees and credentials provides a prism through which the intersection of

underrepresented students, academic unpreparedness, and TN Promise and other free college programs can be examined.

Education and Employability

In addition to the fiscal remuneration of investing in higher education, one of the more valuable aspects of American higher education is the industry's capacity to adapt "in response to society's needs for knowledge, expertise, and leadership," and students with access to postsecondary education are better prepared to function within a "knowledge-based economy and pluralistic, globally interconnected world of the twenty-first century" (Thompson, 2014, p. 3). Indeed, workers who earn two- or four-year degrees typically receive both general education and specific career-oriented skills that provide an almost absolute competitive advantage in the economy (Carnevale et al., 2020). The confluence of postsecondary credentials and hiring preferences is expected to continue. Economists at the Georgetown University Center on Education and the Workforce estimate that two out of every three jobs in the United States will require some postsecondary education by 2025 (Bottoms & Sundell, 2017).

Higher education participation and certificate or degree attainment serve to buttress against employment and income loss during periods of economic downturn even as the individual economic benefits of postsecondary credentials vary by level and field of study. According to Carnevale et al. (2016), beginning in January 2010 following the Great Recession, employees with some college education obtained 11.5 million out of the total 11.6 million jobs created during this period, and likewise attained the vast majority of quality jobs that pay $53,000 per year with benefits such as health insurance. Workers limited to a high school diploma or less lost 5.6 million jobs during the recession, but only recaptured 80,000 new jobs during the recovery period up to April 2016 (Carnevale et al., 2016). Whether the economy has

artificially shifted educational expectations of workers or postsecondary participation naturally provides positional advantages for employability, college attainment has emerged as a vital component of economic welfare.

Despite evidence of the financial and social benefits of higher education, individuals' inclinations and opportunities to access postsecondary institutions can vary depending on social expectations and institutional purposes. Barriers such as tuition and other affiliated expenses, opportunity costs, and time and intellectual commitment, including delays posed by academic unpreparedness, diminish the individual expectations and institutional return on investment of higher education attainment. Simultaneously, constraints of public financing, financial aid, and the disconnect between the preparatory readiness of secondary education contribute to a divide between the private and public benefits of higher education, thus creating uncertainty in individual decisions regarding the undertaking of college education (Chan, 2016).

Upward Mobility

Economic mobility represents a significant, if not primary, motivator for students to pursue postsecondary degrees. Labor market access in the United States has become increasingly correlated with postsecondary credentialing as the rate of workers with college degrees have increased from 28% in 1973 to 59% in 2010, with that rate projected to reach 65% by 2020 (Carnevale et al., 2013). Public awareness of the importance of postsecondary attainment to individuals' financial viability is aligned with increased demands for college degrees as college-going rates have likewise increased from 45% in 1960 to 66% in 2013 (Bok, 2013).

Access, persistence, and completion are important components of socioeconomic mobility for all populations, though disparate rates of mobility hinder progress among African Americans. Chetty et al. (2014) found that socioeconomic mobility is lower for African

Americans and for White individuals dispersed amongst communities with large African American populations. According to Berg (2016), race and socioeconomic status are interlocked attributes that negatively affect African American and Latino students' academic performance and subsequent postsecondary attainment due to their relative socioeconomic deprivation, group segregation, and stigmas of inferiority relative to White and Asian students. Though a relative lack of research exists indicating the comparative benefits of the outcomes of college-going amongst represented and underrepresented student populations, existing results indicate that students from traditionally underrepresented populations might benefit even more from postsecondary enrollment than students from more advantaged backgrounds (Giani et al., 2019).

Generational income is linked to postsecondary access and the further persistence of income gaps. Low-income students have a relatively lower rate of college attendance than their higher-income peers. Among high school graduates in 1992 who were identified as prepared for college, only 52% of low-income students and 62% of middle-income students enrolled in college by 1994 compared to 86% of higher-income students who graduated in 1991 and subsequently enrolled in four-year universities within two years (Bok, 2013). Chetty et al. (2014) found that a child's college going rate increases by 6.7% for every ten percentage points of parental income.

Students whose parents lack postsecondary experiences can be considered as having a comparative disadvantage relative to students whose parents attended or completed college, and this generational barrier diminishes opportunities for first-generation students to attain college credentials and related socioeconomic benefits.

Tennessee (TN) Promise

Tennessee (TN) Promise represents a multifaceted approach to postsecondary access that presents conflicting opportunities to both improve college attainment rates and to exacerbate rates of inequality among disparate student populations. The Promise program is, in part, an attempt to provide continued postsecondary access by reducing costs at a time when increases in tuition costs surpass inflation and loan borrowing has also accelerated (Malcom & Feder, 2016). Though this program's marketing and mentoring aspects present an access point for underrepresented students who might otherwise disregard postsecondary education, many within this population carry with them academic, socioeconomic, or intergenerational barriers that strain the capacities of institutions and are left unresolved by the program's design. An explication of the origin, purpose, design, and measured effects of TN Promise provides a context for how rates might increase for academically underprepared students in need of remediation.

Origin of TN Promise

The TN Promise program was preceded by a regional tuition-based scholarship and advising program called Knox Achieves. Knox Achieves was established in 2009 as a regional need- and merit-neutral financial aid program that provided last-dollar funding for Knox County students (Carruthers & Fox, 2016). TN Promise formally began with the inaugural 2015 class and provided an antecedent to the national movement of federal- or state-sponsored community college education. The program served as the backdrop when President Obama announced a similar national plan, America's College Promise, which would cover approximately three-quarters of the cost of community college tuition for students in all states willing to participate (Stinson, 2015).

TN Promise was designed as a supplement to federal and state aid relative to how America's College Promise would function, though, unlike America's College Promise, TN Promise was successfully implemented and utilized by Tennessee students. The Tennessee Higher Education Commission (2019, p. 7) describes the TN Promise program as "a last-dollar scholarship that affords recent high school graduates the opportunity to complete an associate degree or certificate program free of tuition and mandatory fees" at public Tennessee community and technical colleges.

Eligibility Process

The program's qualification procedures are regimented and designed to provide a secondary benefit to the scholarship's financial award. Though variations of application processes and deadlines have existed over time, the current qualification process for high school seniors includes mandatory Promise application completion by November 1, Free Application for Federal Student Aid (FAFSA) submission by a targeted date each year, attendance at a mandatory information session, completion of eight community service hours with a partnering agency, and fulltime enrollment at an eligible institution in the fall semester following their graduation (THEC, 2019). Such procedures inculcate students with the admissions and enrollment processes and result in compulsory, timely enrollment to maintain eligibility.

Additionally, applicants are matched with mentors who have an interest in encouraging members of their community to pursue postsecondary education beyond high school (Smith & Bowyer, 2016). Mentors are meant to provide students with encouragement and guidance through the Promise application and college enrollment processes. Mentors are identified through local communities by one of three partnering agencies, including TN Achieves, the

Regional Economic Development Initiative, and the Ayers Foundation, and these agencies also manage the collection and verification of community service hours (Smith & Bowyer, 2016).

Purpose and Context in Tennessee

TN Promise serves as the cornerstone and primary mechanism for the state's broad Drive to 55 initiative wherein Tennessee colleges, universities, state agencies, and communities collaborate to achieve a 55% postsecondary credential attainment rate by 2025 (Smith & Bowyer, 2016). The model of accessibility provided by programs like TN Promise are particularly attractive to community colleges because these institutions provide students with relatively lower tuition costs and lower opportunity costs, including the capacity to maintain employment and for incoming high school students to remain in their parental households (Reynolds, 2012). Students with financial constraints who are vulnerable to the expenses of postsecondary education have a higher rate of accessibility to institutions with lower tuition costs and better opportunity costs. Additionally, two-year colleges require states to commit far fewer resources than their four-year counterparts and thus provide more cost-effective alternatives at which students can begin postsecondary enrollment (Reynolds, 2012). The enrollment and accessibility objectives of TN Promise and similar programs align well with the financial and academic structures of two-year colleges.

In addition to the financial aid and fiscal purposes of TN Promise wherein more students are incented to attend college, other anticipated impacts include an increased awareness of financial aid availability and improved rates of application for financial aid, an increase in community engagement and mentoring, and an overall improved awareness of the value of higher education to Tennessee and its residents (Smith & Bowyer, 2016). The program's procedures are designed to result in higher rates of access to federal financial aid resources and

consequent pursuit of postsecondary opportunities for Tennessee students, regardless of their eventual qualification for or receipt of TN Promise funds.

Effects on Student Preparation

TN Promise and other expansionary access programs intersect with academic remediation efforts because such programs are based on the expectation of increased postsecondary enrollment and consequent increase in students below college-level. According to administrators at three Tennessee community colleges, the influx of students with learning support and remediation needs strained institutional resources and offerings despite the institutions' capacities to serve such populations (Littlepage et al., 2018). Minority students, who are relatively reluctant to amass debt associated with postsecondary enrollment, represent a significant component of the presumed increase of students, and many such students need remediation to improve basic skills in reading, writing, and math (Stern, 2015). The Complete College Tennessee Act of 2010, which served as an overarching postsecondary policy guide and a complement to TN Promise, articulated a Tennessee Transfer Pathway model to guarantee credit transfers from community colleges to Tennessee universities as well as a mandate for developmental and remedial courses to be offered solely by community colleges (Smith & Bowyer, 2016). However, students in need of remedial preparation and students who intend to transfer are more likely than their peers to experience a loss of financial aid eligibility due to surpassing eligibility limitations (Malcom & Feder, 2016). The TN Promise program itself does not replace federal aid eligibility, nor does it alleviate the administrative and personal burdens of developmental coursework.

Population and Demographics

According to the Tennessee Higher Education Commission (2021), TN Promise attracted 57,692 applicants during its inaugural year in 2015. The number of applicants increased to 64,249 with the fifth cohort in 2019, including 18,991 students who qualified for TN Promise and enrolled at an eligible postsecondary institution (THEC, 2021). The accessibility and marketing of the application process are intended to enroll as many students as possible to facilitate maximal postsecondary participation and degree production.

Students who qualified for TN Promise and enrolled at eligible institutions between the 2015 and 2017 freshman classes were not representative of Tennessee's general racial and gender diversity. Relative to all Tennesseans between the ages of 15 and 19, male, African American, and Hispanic students were underrepresented (THEC, 2019). A notable trend is the disparity between African American applicants and Promise recipients. The 2017 cohort of incoming freshmen included a 20.7% rate of African American applicants and a 13.3% rate of African American students who were ultimately certified as eligible, while White students of the same cohort increased from 61.7% to 71.8% (THEC, 2019). Likewise, the median adjusted gross income for all cohorts on record increased significantly from the applicant population to the eligible enrollee population, indicating that underrepresented students of various demographic profiles are less likely to enroll at eligible community and technical colleges relative to higher-income or White peers.

Data regarding the comparatively low rate of low-income students certified as eligible for TN Promise supports the assessment of Poutre and Voight (2018) regarding the lack of financial support for low-income and working-class students who have a greater need of support with educational expenses. The function of TN Promise contrasts with the supplementary design of the aborted America's College Promise initiative proposed by the Obama administration that

would have paid most community college expenses without accounting for students' receipt of Pell Grant and other gift aid (Stinson, 2015). Utilization rates among low-income Promise applicants might diminish because of its last-dollar function and the declined purchasing power of Pell Grant relative to current tuition costs and educational expenses (Poutre & Voight, 2018).

Outcomes of TN Promise

The free-tuition program model and messaging surrounding TN Promise is intended to serve as a policy lever to incent college enrollment and, hopefully, to increase degree attainment rates. Carruthers and Fox (2016) found that participants in the TN Promise predecessor, Knox Achieves, were 24.2% more likely to enroll in college and 29.6% more likely to enroll in community college than matched peers without access to that program. Beginning with its inaugural cohort, the TN Promise program has successfully produced enrollment gains among Tennessee college students. According THEC (2021), TN Promise implementation resulted in a college-going rate increase of 58.9% to 64% in its initial year, and the Promise participant population increased to 18,991 in 2019 from its first cohort of 16,207 in 2015.

The predecessor of TN Promise, Knox Achieves, was shown to have college-going benefits for participants, particularly lower-income students whose participation in the program did not result in any last-dollar tuition assistance because of their eligibility for other financial aid resources. According to Carruthers and Fox (2016), the mechanisms through which Knox Achieves operated likely benefited students who were ineligible to receive the financial benefits of the program, indicating that the program design addressed students' misconceptions regarding financial aid eligibility and college enrollment.

Like the unbalanced effects of Knox Achieves, the financial model of TN Promise in which federal need-based aid resources, such as Pell Grant, and state merit-based aid resources,

such as Hope Scholarship, are applied first has been shown to disproportionately benefit higher-income students relative to low-income students. Poutre and Voight (2018) found that Pell Grant recipients do not typically receive funding from TN Promise because of its last-dollar format, thus resulting in an inequitable postsecondary incentive program that does not primarily advantage low-income students. Jones and Berger (2018) found that TN Promise is not targeted toward low-income students and has likewise experienced lower participation rates among African American and Latino students relative to White students. Though 71% of eligible White students enrolled through TN Promise participation, African American and Latino students enrolled at rates of 46% and 56%, respectively (Jones & Berger, 2018). The lack of equitably distribution of program benefits among underrepresented student populations, including low-income and minority African American and Latino students, indicates a structural deficiency that limits the effectiveness of this program as a postsecondary access mechanism.

College Bridge Programs

College bridge programs present opportunities to both complement traditional placement and remediation models and to supplant these models as a replacement approach. Bridge programs provide opportunities for students enrolling at colleges and universities to close the gap between academic preparedness and college readiness and thereby limit the need for burdensome developmental coursework and remediation (Kodama et al., 2018). Bridge programs are intended to assist first-time and fulltime students in their transition to postsecondary education (Sasso et al., 2019). Such bridge programs can improve college readiness, often conceptualized cognitive and non-cognitive skills, behaviors, and knowledge that shape individual students' likelihood of attaining a college degree (Nagaoka et al., 2013). Bridge programs redress academic and non-academic deficiencies that would otherwise limit students' capacities to matriculate.

According to Barnett and Reddy (2017), the examination of different forms of college placement or preparation is needed to identify alternative ways to onboard students. Bridge programs that diminish curricular and nonacademic gaps for incoming students are options to replace placement testing and remediation. Relative to other academic and social interventions, bridge programs can be designed using existing faculty, staff, infrastructure, and initiatives to provide effective benefits for developmental students that are less costly than the creation of new interventions (Bir & Myrick, 2015).

Description of Bridge Programs

College bridge programs are typically multi-week plans intended to introduce students to the academic, social, and cultural expectations of higher education, help students adapt to the college academic environment, and to prepare them for the rigors of college curriculum (Bir & Myrick, 2015; Cabrera et al., 2013; Cooper et al., 2017; McCurrie, 2009). Bridge programs serve as preparatory interventions preceding postsecondary enrollment to ease the transition from high school and to increase students' academic momentum as they enter college (Cabrera et al., 2013; Wachen et al., 2018). Colleges can implement bridge programs around career counseling and exploration initiatives in addition to an emphasis on basic academic skills (Cohen et al., 2014). Irrespective of the myriad designs and purposes of bridge programs, each is intended to inculcate underprepared or at-risk students with a college-going mentality and curricular skills requisite for matriculation.

Target Populations

Bridge programs, unlike broader postsecondary initiatives that serve schools or classrooms, target individual students based on singular or collected academic or experiential deficits that might impede their matriculation (Kallison & Stader, 2012). Students who

participate in college bridge programs typically lack academic or cultural readiness for postsecondary experiences, though this target population coincides with underrepresented minorities, non-traditional, first generation, low-income, and at-risk students (Kallison & Stader, 2012; McCurrie, 2009). Bridge programs are designed and implemented to serve numerous cognitive and non-cognitive purposes for a variety of student populations.

Bridge programs were originally designed for academically challenged students, but recent formats of bridge programs have focused on culturally diverse students who are traditionally underrepresented in higher education (Arendale & Lee, 2017). For example, African American male students are particularly susceptible to postsecondary attrition relative to White male students and White and African American female students. A possible deficit for African American males is the lack of rigorous secondary school preparation prior to postsecondary enrollment (Bir & Myrick, 2015). Some bridge programs are designed for low-income students, and colleges in Alaska, Hawaii, and Washington provide a coordinated bridge program for Native students in science and engineering programs (Cohen et al., 2014).

In addition to socioeconomic and demographic indicators, students who enroll in majors in the disciplines of Science, Technology, Engineering, and Mathematics are targeted populations for specialized bridge programs. Underserved students who desire to pursue STEM field majors tend to have lower ACT benchmark indicators than their better-served peers, and this disparity is more significant for students who experience more than one underserved attribute (Lane et al., 2017). Students in STEM fields are expected to enroll in Calculus and begin engineering coursework in their first semester of study, but prerequisite remediation extends their enrollment and serves as an impediment to retention and graduation (Cancado et al., 2018). The National Science Foundation funds bridge programs to increase the number of

students who pursue programs in science, engineering, and mathematics (Cohen et al., 2014). Similarly, while there are few reports that track institutional-level STEM performance and retention, particularly among underrepresented students, there are programmatic efforts implemented at institutions, including pre-freshman summer bridge programs, designed to help students establish confidence in science skills and motivate and internalize the importance of STEM disciplines for the purposes of improving minority student persistence in STEM majors (Estrada et al., 2016).

Some bridge programs provide stipends to special populations, such as the tribal student-focused Turtle Mountain Community College program (Cohen et al., 2014). A bridge program for expectant underrepresented, disadvantaged minority students at the University of Tennessee Health Science Center provides a $1,000 stipend for program completers to help alleviate financial constraints that can result from participation in an intensive, multi-week preparatory intervention (Norris et al., 2016).

The concept of providing students with a transitionary intervention to accelerate secondary learning outcomes to college-level preparedness neglects students who are several years removed from high school. Nontraditional students whose postsecondary enrollment was delayed by economic or family interests are a target demographic for bridge programs, particularly because these students often seek vocational, technical, and STEM programs at community colleges that necessitate immediate credit-bearing coursework (Lenaburg et al., 2012).

Purposes of Bridge Programs

Bridge programs serve to both enable students to succeed in their higher education experiences and increase the institutional outcomes of cohorts and classes of students. From an

institutional perspective, individual colleges and universities will benefit from improved rates of student success. As such, bridge programs provide customized content to assist students with higher rates of academic struggles and withdrawal as they transition to postsecondary education (Arendale & Lee, 2018). According to Chen (as cited in Cooper et al., 2017), bridge programs are implemented to counteract the high rates of student attrition during the first year of college.

Curricular and social acclimation for bridge participants can include academic and course instruction, time management, notetaking, career and academic counseling, parent participation, computer literacy, English, literature, and math development, journal-writing activities, campus adaptation, and supplemental instruction (Lopez, 2016). Most college bridge programs likewise convey to participants how to utilize campus services, such as libraries and tutoring, and expose them to faculty (Cabrera et al., 2013). According to Quiroz and Garza (2018), summer bridge programs are instituted to improve academic and social engagement among students whose demographic characteristics, finances, or academic preparation are associated with lower levels of retention. Some bridge programs are conducted as workshops, though some are offered as an academic course that might include financial literacy or access to campus resources (Sablan, 2014).

Results of Bridge Program Analyses

While bridge program implementations and purposes vary amongst institutions, the results of examinations of bridge programs generally indicate favorable results for students from targeted populations. Bridge programs cover curricular content, learning skills, campus enculturation, and other preparatory proficiencies. Thus, assessments of bridge program performance differ depending on program implementation, target populations, program purposes, and methods of data collection.

Literature on bridge programs reveals a scarcity of results, though positive outcomes of various programs have been identified. According to Arendale and Lee (2017), successful bridge programs focus on cognitive and psycho-social factors, peer tutoring, faculty mentoring, cohort development, academic content, and significant investments in bridge programs through the provision of personnel, facilities, and budgets. The U.S. Department of Education, Institute of Education Sciences, and What Works Clearinghouse (as cited in Quiroz & Garza, 2018) identified five characteristics inherent within most bridge programs, including an in-depth orientation to college life and resources, academic advising, academic coursework, academic support to prepare students for the rigors of postsecondary academics, and social support to build networks among students and faculty and to foster a connection to the institution.

Among comparative studies, many indicate positive effects of bridge programs for participants. Wachen et al. (2018) discovered that bridge program participants in the University of North Carolina Academic Summer Bridge and Retention Program outperformed non-bridge participants on measures of credits earned and persistence from their first fall semester to their second fall semester. Similarly, Bir and Myrick (2015) discovered that first-time, fulltime freshmen who participated in a summer bridge program at a midsize HBCU earned significantly higher GPAs and achieved higher first- and second-year retention rates. Similar benefits in second-year retention for bridge program participants were identified by Douglas and Attewell's (2014b) analysis of a 6% higher retention rate for CUNY students.

Qualitative results of student experiences following bridge interventions are also valuable contributions to the body of research regarding the usefulness of bridge programs. Walpole et al. (as cited in Kodama et al., 2018) found that bridge program participants experienced increased

academic and social engagement during their first two years compared to non-bridge participants.

Bridge programs that do not directly intend to improve academic performance or college experiences, such as bridge programs designed to increase placement test scores and college-level placement, can improve student and institutional outcomes. Kodama et al. (2018) studied more than 1,600 students who participated in a summer bridge program designed to improve placements into credit-bearing writing classes and discovered that 83% of participants began their first semester in a college-level writing course following the bridge program. Kodama et al. (2018) determined that bridge program participants benefited from higher first-semester GPAs, earned significantly more first-year credits, and experienced higher graduation rates than non-bridge participants.

Lonn et al. (2015) studied the results of 216 participants in a seven-week summer bridge program designed to provide intensive academic preparation, advising, and community building to students at a large, more selective Midwestern university. The bridge participant profiles represented several at-risk demographic indicators, including 69.4% minority students, 24.1% students with family incomes of $25,000 or less, and 21.8% first-generation college students (Lonn et al., 2015). Based on results from paired-sample t-tests, Lonn et al. (2015) determined that the use of guided presentations of student performance had significant effects on students' academic achievement, motivational orientation, and persistence.

Bridge programs for at-risk, underprepared student populations can benefit students of different demographic and risk indicators, though performance gains can indicate disparate benefits for male and female students. Bir and Myrick (2015) studied the outcomes of 1,891 full-time freshmen who participated in a summer bridge program at a midsize HBCU. Despite having

lower high school GPAs and SAT scores than non-bridge participants, the female bridge program participants experienced higher retention and graduation rates than male participants and male and female non-bridge participants (Bir & Myrick, 2015). Though the study included inconsistencies in statistical significance relative to non-significance, Bir and Myrick (2015) concluded based on data from three cohorts that bridge participants were more likely to remain engaged during their first year and persist to their second year.

Concerns of motivation and self-selection among bridge participants relative to non-bridge participants might diminish the applicability and scalability of bridge programs. Academic underpreparedness and risk indicators can be determined by institutions, but bridge program capacities and the rate at which institutions can enroll students in bridge programs are largely tied to student impetus. Frost and Dreher (2017) analyzed outcomes data for a four-week online summer mathematics bridge program for 81 incoming students who self-selected into the program to improve their placement test scores. Based on results from a two-tailed paired t-test analysis of the 68 participants who took the placement test both before and after the program, 61.7% of participants improved their placement in a more advanced mathematics course in the subsequent fall semester (Frost & Dreher, 2017). Additionally, 72.3% of the 47 participants who completed the full bridge program and enrolled in a mathematics course passed their course attempt, which represented a higher pass rate in College Algebra and Intermediate Algebra than the general student population (Frost & Dreher, 2017). Bridge programs that focus on placement test improvement and remediation circumvention might also contribute to academic performance for program participants.

Bridge programs can emulate several college experiences, such as course structure, faculty interactions, bureaucratic enrollment procedures, and curricular content, which provide

underserved and at-risk students with a relatable college experience prior to their first semester. Lane et al. (2017) analyzed a six-week summer bridge component of a broader STEM intervention program at Jefferson State University and found that most participants responded favorably to the cognitive gains in their math comprehension. According to Lane et al. (2017), underserved students are more significantly affected by the bureaucratic, transitional barriers associated with the admissions and enrollment process, and participants in the Comprehensive STEM Program indicated that the bridge program allowed them to address transitional concerns prior to the weeks immediately preceding the fall semester and made them aware of learning gaps that they would have otherwise carried into their first semester (Lane et al., 2017).

Shifting trends in national demographics do not align with current educational attainment rates in specialized programs. Racial and ethnic minority students are underrepresented in healthcare fields like the underrepresentation they experience in STEM majors. Norris et al. (2016) analyzed data from 33 disadvantaged, underrepresented students who participated in a summer prematriculation bridge program designed to increase access rates to nursing programs. All but one participant scored below average on the baseline vocabulary and reading comprehension components of the Nelson-Denny Reading Test that was administered following the program, and only 39% of participants were subsequently accepted into a bachelor, master, or associate degree nursing program (Norris et al., 2016). Norris et al. (2016) determined that the program provided opportunities for participants to bond with peers and faculty and that the $1,000 stipend component of the program allowed for participants to gain understanding of nursing admissions policies, writing effective personal statements, and financial aid navigation necessary for entry into a nursing program, but that additional evidence-based interventions and fundamental educational reforms are necessary to improve access to healthcare programs for

underrepresented students. Results that indicate mixed outcomes or limited benefits emphasize the lack of data and analyses available to make broad judgments or provide specific programmatic recommendations for more expansive bridge initiatives.

Need for Additional Research

Whereas specific bridge program analyses exist to review the outcomes of often narrowly targeted populations of students, there remains a paucity of bridge program results to justify widespread application. A lack of longitudinal studies makes it difficult to establish measurable, substantive benefits for student participants and institutions (Kodama et al., 2018). Studies that examine the quantitative or qualitative data indicating the results or failures of bridge programs are scarce relative to other interventions. Despite the prevalence of bridge interventions at community colleges and universities throughout higher education, there are few empirical analyses available (Sablan, 2014). Arendale and Lee (2018) posit that the existing literature relies too much on single studies and leaves gaps in knowledge of experimental research, first-year experience programs, and bridge programs for transfer students. Much of the research conducted on bridge program outcomes involves program implementation rather than evaluative efforts to determine program efficacy (Quiroz & Garza, 2018). Garcia and Paz (2009) reviewed four bridge programs at a single, multi-campus public university system and found that administrators evaluated the outcomes of only one program in a partially complete method, but the remaining programs were appraised based on end-of-summer questionnaires similar to course evaluations. Though these programs have remained funded since the 1960s and 1970s, program evaluators have not undertaken rigorous quantitative or qualitative studies to determine the effects, if any, that the bridge programs produce.

Existing literature provides limited definitive evidence of the benefits provided by bridge programs of any type. Barnett et al. (2012) examined a summer bridge program conducted at eight postsecondary institutions in Texas and found that the program induced moderate short-term benefits, but a lack of definitive long-term success, low resultant gains in credit hours earned, and the high cost of program delivery indicated questionable advantages. The costs associated with extracting either short- or long-term benefits is a variable that affects the applicability of bridge programs regardless of their efficacy as opportunities for academic rehabilitation or social integration. In a related study, Chingos et al. (2017) found that an $83 online adaptive learning tool did not result in remedial math students improving their placement, earning higher GPAs, or earning more math credits during their first year. Though this study produced a low-cost valuation for a summer academic rehabilitation program like a bridge program, the narrowly defined population and self-study design provides an incomplete analysis of the potential of similar programs.

Greer et al. (2020) examined outcomes of summer bridge participants at a small liberal arts college and found that low-income bridge participants were more likely to graduate than similarly positioned low-income non-bridge participants, but these participants were not more likely to achieve higher GPAs than their non-bridge counterparts. Such outcomes provide some correlation to bridge program participation and success, but the mechanism by which bridge program participants achieve better graduation rates is questionable if GPA rates remain comparable to non-bridge participants.

Programs are frequently evaluated with satisfaction surveys wherein participants can describe their positive or negative experiences or gauge how well their program prepared them for the college experience (Cabrera et al., 2013). Additionally, there is little research that

analyzes the costs of bridge programs and evaluates their cost effectiveness, despite the importance of cost efficacy as a determinant in the continuation of bridge programs (Wachen et al., 2018). Because of the propensity for bridge programs to service traditional, underrepresented, and low-income student populations, much of the research that exists excludes the effectiveness of bridge programs for nontraditional students (Hoops & Kutrybala, 2015).

Summary of Literature

Higher education presents opportunities to resolve social and economic disparities for students from backgrounds who have been otherwise excluded from or unable to access the economic benefits of degree attainment. However, academic unpreparedness presents certain barriers that prevent equitable access and matriculation to many students, thus limiting retention, graduation rates, and their related advantages. Astin's theory of involvement posits that students' performance can improve if their college motivations and commitments are enhanced, and the effectiveness of college initiatives should be evaluated thusly. Similarly, Tinto's theory of student departure indicates that postsecondary commitments are in competition with other life circumstances and that students must separate from past associations and transition into the norms and expectations of college enrollment to succeed (Tinto, 1988). Astin and Tinto's models are helpful contextualizations of how many underrepresented students might experience college and how colleges might act to ameliorate concerns of access, retention, and completion.

Despite the advent of postsecondary expansion initiatives such as Tennessee Promise, academic deficiencies relegate up to 68% of public two-year college students and up to 40% of public four-year college students to at least one remedial course (Chen & Simone, 2016). Research into the effects of developmental education for marginal students and students in need of intensive remediation has not yet provided conclusive results, or results from such research

indicate variable effects, if any, depending on students' disparate academic preparation (Boatman & Long, 2018; Scott-Clayton & Rodriguez, 2015).

Underrepresented students, including ethnic minorities and low-income students, are more likely to experience barriers associated with placement testing and remedial education (Logue et al., 2017). Underrepresented students are overrepresented within remedial and developmental coursework, including 56% of African American students, 45% of Hispanic students, and 55% of Pell Grant recipients (Complete College America, n.d.). Relatedly, underrepresented students are likewise likely to experience greater gains from postsecondary participation relative to students from high-income or represented backgrounds (Giani et al., 2019). The confluence of disproportionate barriers and benefits for this population of students suggests that interventions that improve college-going rates for underrepresented students could complement the similarly disproportionate socioeconomic gains experienced by this population.

As indicated by recent studies, postsecondary degree attainment and even college enrollment that does not end in credentialling provides students with higher rates of employability, job gains, and income relative to individuals whose education concludes with a high school diploma (Carnevale et al., 2016; Kim & Tamborini, 2019). Indeed, research has indicated that both postsecondary matriculation as well as attempts at postsecondary engagement result in better earnings and rates of employment for all student groups beyond high school, including minority and underrepresented students (Giani et al., 2019; Kim & Tamborini, 2019). Though students should not be limited to incomplete college credentials, the correlation between improved economic prospects and college enrollment underscores the importance of postsecondary access and necessitates interventions to ensure the best possible outcomes for all participants.

Bridge programs present an opportunity to improve the educational prospects of academically underprepared and underrepresented college students, thereby providing them with myriad financial, socioeconomic, and other benefits. Such academic interventions can complement or supplant other more costly forms of remediation by addressing cognitive and non-cognitive skills necessary for collegiate success, thereby improving student readiness and performance (Nagaoka et al., 2013). Current research indicates a scarcity of validation through bridge program outcomes and an established body of data that indicate determinate, meaningful outcomes for students and colleges (Kodama et al., 2018).

Despite a critical absence of prevalent research into the outcomes of bridge programs, many studies have documented various quantifiable advantages for student participants, including higher rates of earned credits, persistence, and grade point averages (Bir & Myrick, 2015; Wachen et al., 2018). Thus, bridge programs represent potential programmatic initiatives that close postsecondary access gaps between underrepresented and low-income students and provide them with an increased likelihood to experience the financial benefits of college enrollment and completion.

Chapter 3. Methodology

The purpose of this study is to compare outcomes of academic performance among first-year college freshmen following participation in a summer bridge program. This chapter reviews the research design, research questions, statistical analyses used to measure data, the population of students analyzed, a description of the collection of data, and the outcomes of data analysis.

This study relied on existing data from academic records to assess possible performance disparities between comparable students. A nonexperimental comparative design was applied to evaluate first-year metrics and determine whether summer bridge participation affected academic performance. This comparative design was employed because of its purpose of investigating a cause and effect of an independent variable, namely bridge program participation, and academic performance between two groups without the need to manipulate any variables (Brewer & Kuhn, 2010).

An example of a similar research design might include a comparative analysis between a group of students who completed an ACT preparation program with a group of students that was not exposed to the independent variable (Brewer & Kuhn, 2010). Villiger et al. (2019) studied a comparison of parent-guided tutoring and volunteer-guided tutoring on struggling readers and found that volunteer-guided tutoring resulted in significantly better reading fluency. Vidalakis et al. (2013) used a comparative approach to evaluate the relationship between the quality of facilities and the value those facilities contribute to students and higher education institutions. Such studies utilize a similar research design for purposes of comparing groups of students based on independent variables like an interventional college bridge program.

Advantages of anonymized, existing, nonexperimental student academic records include ethical considerations, availability, accessibility, and consistency of these data. Reliance on existing data with an available independent variable resolves potential conflicts of ethics because

the study does not require additional manipulation of student participation that might advantage or disadvantage students (Brewer & Kuhn, 2010). Summer bridge participation occurred prior to and independent of this analysis as a complementary and supplementary program to support the state's Tennessee Promise program.

There was no loss of integrity in student records, and all data were accessible from the same student record system and the same Banner forms and tables. Such consistency limits the possibility of errors or misinterpretations of data during the collection and analysis process such that might occur in a survey or qualitative research design. According to Cheng and Phillips (2014), though the development and use of primary data permits more flexibility in terms of research targets, the use of existing data from student records allows for either a priori hypotheses or data-driven development of research questions based on a cursory glance at the existing data. Furthermore, the secondary data available for the purposes of this study were based on a priori hypotheses of postsecondary interventions and student performance, as well as an understanding of the consistency and integrity of the available secondary data sources.

Another advantage of this design was the provision of this non-experimental program to a relatively large population of students and the freedom from costs associated with conducting a largescale intervention or experiment. Access to and use of existing data between bridge participants and non-bridge participants provides an ease of analysis, whereas a comparable experimental study might be considered impractical or impossible because the costs of preparing bridge program content and staffing personnel would exceed the value of the study's results.

Finally, a comparative design provided the opportunity to evaluate bridge program participation and subsequent academic performance by comparing student outcomes among participants and non-bridge participants. Completion of a bridge program can be interpreted as a

causal factor in the observed academic outcomes of bridge students relative to non-bridge participants based on comparable demographic, socioeconomic, and academic variables among both populations (Witte & Witte, 2010).

Among the disadvantages of the non-experimental comparative design, the reliance on non-experimental, anonymized existing data removes the possibility of assessing a qualitative, subjective value that bridge program participation might produce and limits the efficacy of results. According to Brewer and Kuhn (2010), many critics of a causal-comparative design dispute that any causal relationship can be determined without true experimental evaluation. A nonexperimental comparative design relies on the existing attributes of two groups and lacks any influence over the dependent variable.

Bridge participants' self-selection to undergo this opportunity could be considered a disadvantage as it occurred outside of the scope of this analysis. The motivation to pursue a summer bridge program opportunity cannot be controlled for when comparing participant performance outcomes to the outcomes of non-bridge participants. This type of study occurs ex post facto and provides no opportunity to control the selection of group participants in relation to bridge program completion (Brewer & Kuhn, 2010).

Reversal causation might diminish the certainty of comparative results between participants and non-bridge participants. Reversal causation results when a dependent variable might be affected by influences beyond the scope of the independent variable in a nonexperimental comparative study (Brewer & Kuhn, 2010). Though bridge participants and non-bridge participants are comparable among numerous variables, including remedial placement test scores and TN Promise eligibility, some differences that might affect academic outcomes are impossible to account for in a nonexperimental, ex post facto study environment.

Finally, sampled students are restricted by their eligibility for the TN Promise grant. As such, nontraditional students and other comparable first-time freshmen who did not qualify for TN Promise are excluded from consideration. TN Promise is not a merit-based or need-based program, so its recipients are not unrepresentative of a distinct subpopulation of students. However, the results of this analysis might not apply to other student populations who are further removed from high school graduation, unlike the recent high school graduates included in this study.

Data Source

The analysis to determine if significant differences exist between summer bridge program participants and comparable non-bridge participants did not include any experimental aspects or collection of survey data. Student record data was collected for all students who enrolled in the summer bridge program in 2015, 2016, 2017, 2018, and 2019. Participants who did not enroll in the fall semester following completion of the bridge program was removed from analysis.

Though measures of academic performance remained the same throughout each sample, the college's placement test varied between Accuplacer and EdReady. Placement tests are expected to provide comparable measures of student aptitude and subsequent assignment of remediation or placement into college-level coursework, and this analysis did not measure changes in students' placement test scores following completion of the bridge program. Therefore, differences in placement test types applied to each cohort are indicated for the purpose of disclosure, though these differences did not result in any inconsistencies regarding remedial placement as the tests are designed to provide consistent, equivalent measurements of academic preparedness.

Population

The population for this the study included summer bridge students enrolled at a large public community college in Tennessee who were eligible to receive the Tennessee Promise Grant as incoming freshmen between the Fall 2015 and Fall 2019 semesters. Bridge participants were identified as students who tested at remedial levels on the college's placement test and did not have ACT scores or dual credit college coursework that would have preempted placement into developmental courses. According to TN Achieves, the initial bridge program enrollment for each cohort consisted of 37 participants in 2015, 35 in 2016, 35 in 2017, 89 in 2018, and 70 in 2019. However, bridge participants among the total 266 who did not complete the program or did not enroll at the institution were excluded from analysis as they had no performance metrics. A random sample of TN Promise-eligible, developmental students who did not participate in the summer bridge program was identified for purposes of comparison.

Data was accessed from a large public two-year institution that is a member of the Southeastern Association of Colleges and Schools. Overall enrollment in fall 2015 included 9,436 students, including 59.2% female, 21.9% non-White minority, and 40.7% Pell-eligible (Tennessee Higher Education Commission, 2016). Overall enrollment from the final year of data, fall 2019, consisted of 8,148 students, including 61.2% female, 26.1% non-White minority, and 39.5% Pell-eligible (THEC, 2020). According to THEC (2016), 1,966 students in fall 2015 were first-time freshmen. The fall 2019 first-time freshman cohort included 1,682 students (THEC, 2020).

Demographic data and first-generation designations were based on student records accessed through Ellucian Banner. Student ethnicity was reported by students during the admissions process through the college's application. Classifications of ethnicity are determined

by the Tennessee Board of Regents and applicants self-identify one or more ethnic categories during the enrollment process.

The designation of first-generation status is self-reported similar to student ethnicity, though this categorization is selected as part of the Free Application for Federal Student Aid (FAFSA) process. By default, all students registered for the bridge program were eligible for Tennessee Promise, and as such they were required to submit a FAFSA during the relevant academic year. Students must acknowledge the educational level of each parent on the FAFSA. Students are presented with the option to indicate the highest level of educational attainment for their biological parents by identifying Middle School/Junior High, High School, College or Beyond, or Other/Unknown. For the purposes of this study, first-generation status was conferred to students who selected Middle School/Junior High, High School, or Other/Unknown for both parents. Students who selected College or Beyond for one or both parents was assumed as second-generation students. This standard of first-generation identification is common as FAFSA data is often the most readily accessible record for such purposes. However, students can err on either side of this designation, either by overreporting parent educational attainment or underreporting parent educational attainment.

Data Collection

Permission to sample student records and analyze student data was sought and received from the East Tennessee State University Institutional Review Board. Following research approval, bridge participants from the 2015, 2016, 2017, 2018, and 2019 cohorts were identified by the Office of Institutional Effectiveness, Research, and Planning at the study institution. The IERP Office accessed student data from the college's Ellucian Banner record system for all bridge participants and comparison non-bridge participants. Ellucian's Banner student

information system (SIS) maintains uniform data related to admissions, documentation, academic performance, financial aid, and other records. As such, all data used in this analysis are assumed to be consistent and reliable. Data collection and analysis was consistent across each cohort to mitigate any inconsistencies and ensure internal validity.

Though the data was collected from a single site, the sampled participants from all cohorts represented a total of 286 different secondary schools through which they matriculated prior to college enrollment. The study was not limited by its single site data collection because the volume of distinct high schools provides for a robust variation of academic and socioeconomic backgrounds for the sampled participants across five years of bridge programming.

Reported data included random IDs, gender, self-reported race, TBR race, high school attended, high school code, high school GPA, first semester of enrollment, the value of participants' Estimated Family Contribution from the FAFSA, first-generation status, first-semester fall GPA, first-semester attempted and earned credit hours, GPA in any first-attempted college-level Mathematics and English courses, and fall-to-fall enrollment indicators.

With assistance from the Office of Institutional Effectiveness, Research, and Planning, all comparable non-bridge participants were identified from the college's incoming freshman populations for each bridge cohort. Non-bridge participants were incoming freshmen, TN Promise-eligible, and tested as developmental-level in at least one subject area. As such, all non-bridge participants met the same qualifications as bridge program participants. All bridge program participants were identified as developmental-level based on their initial college placement test outcomes, and, therefore, qualified for bridge participation.

Students in both groups whose placement test scores improved to college-level were excluded from data collection and analysis because they were no longer developmental-level at the time of their initial enrollment in college. Student ACT scores were likewise insufficient to justify college-level placement; thus, all students from each population will have unqualified ACT scores for the purposes of college-level coursework in their first year of enrollment. Likewise, students with college-level ACT scores would have been excluded from participation in a summer bridge program and thus not qualified for the purposes of this analysis. All first-year academic data and subsequent fall enrollment data was available for analysis at the time of this study. Fall 2020 represented the persistence semester of the final cohort in 2019.

Data Analysis

Measurements of outcomes included first-semester GPA, first-semester credit completion rates (defined as the percentage of credit hours completed with a D or higher), first-attempted college-level mathematics course GPA, first-attempted college-level English course GPA, and the rate of continued enrollment from fall semester to fall semester. Because students from underrepresented populations typically need additional academic and social supports during their transition to college, disaggregated analyses of first-semester GPA, credit accumulation, and fall-to-fall persistence were necessary to determine if there were differential effects between underrepresented bridge program participants and underrepresented non-bridge participants (Wathington et al., 2016). For the purposes of this analysis, underrepresented students were defined as first-generation, low-income, or ethnically non-White. Categories of analysis delineate between traditionally represented students and underrepresented minority students that consist of all other ethnic categories as reported by each student.

Research Question 1 was analyzed with an independent t-test to examine the differences between bridge program participants and non-bridge participants and their respective first-semester GPAs. The independent variable was the bridge program participants and non-bridge participants. The dependent variable was the resultant GPA after the first semester of college.

An independent t-test was applied to Research Question 2 to examine differences between bridge program participants and non-bridge participants and their respective credit hour completion rate during their first semester in college. The independent variable was the bridge program participants and non-bridge participants, whereas the dependent variable was the ratio of credit hours completed with a passing grade relative to the overall number of credit hours attempted.

Research Question 3 was analyzed with a chi-square test to examine differences between bridge program participants and non-bridge participants regarding their fall-to-fall persistence rates. Successful persistence was indicated nominally as a Yes or No. Bridge program participants and students who did not participate were indicated categorically.

Research Question 4 was analyzed using an independent t-test to examine differences in a first college-level Mathematics course GPAs between bridge program participants and non-bridge participants. Like Research Question 1, Mathematics course GPA represented the dependent variable and the independent variable was the bridge program participants and non-bridge participants.

Likewise, Research Question 5 was analyzed using an independent t-test to examine differences between bridge program participants and non-bridge participants and their respective first college-level English course GPAs. The independent variable was the bridge program

participants and non-bridge participants, and the dependent variable was the GPA in English courses during the first semester of college.

Research Question 6 focused on first-semester GPAs of underrepresented bridge participants and underrepresented non-bridge participants. An independent t-test was used to examine differences in first-semester GPAs among underrepresented students who completed a summer bridge program and underrepresented students who did not participate in a bridge program. The independent variable was the underrepresented bridge program participants and underrepresented non-bridge participants and the resultant first-semester GPA for each group represented the dependent variable.

Research Question 7 was analyzed with an independent t-test to examine differences between underrepresented bridge program participants and underrepresented non-bridge participants regarding first-semester credit hour completion rate. The ratio of credit hours successfully completed relative to attempted credits represented the dependent variable and the independent variable was the underrepresented bridge program participants and underrepresented non-bridge participants.

Finally, Research Question 8 was analyzed using a chi-square test to examine differences between fall-to-fall persistence rates among underrepresented bridge program participants and underrepresented non-bridge participants. Like Research Question 3, a Yes or No was used as a nominal data for the chi-square test. Underrepresented students who completed a bridge program and underrepresented students who did not complete a bridge program represented the two categories in the analysis.

To compare bridge program participants' subsequent student outcomes relative to non-bridge participants, analyses included independent t-tests and chi-square tests. Independent t-

tests were applied to research questions focused on differences between dependent variables, including first-semester GPA, first-semester credit completion rates, first college-level Mathematics course GPA, first college-level English course GPA, underrepresented students' first-semester GPA, and underrepresented students' first-semester credit completion rate (Research Questions 1, 2, 4, 5, 6, and 7). Research Questions 3 and 8 relied on chi-square analyses because the data is binary and nominal. All data was analyzed at the .05 level of significance. Independent t-tests and chi-square tests were applied to population data for each research question using IBM Statistical Package for Social Sciences (SPSS).

Chapter Summary

Chapter 3 describes the study's methodology, including research questions, instrumentation and descriptions of students' placement test scores and other demographic, academic, and financial attributes, collection of data, and the methods of analysis applied to the collected data. The researcher found no critical ethical considerations as there were no interventions applied to the student populations and data was anonymized prior to analysis and dissemination. Statistical tests were likewise described in Chapter 3 to ensure validity and reliability. Chapter 4 includes the results of statistical tests applied to participant and nonparticipant data, as well as the outcomes of comparative analysis based on bridge program participation. Chapter 5 details the researcher's findings and conclusions based on the results of the analysis. The study's limitations and recommendations for future bridge program research are also reviewed in Chapter 5.

Chapter 4. Findings

The purpose of this study was to compare outcomes of academic performance among first-year college freshmen following participation in a summer bridge program. Existing data was analyzed to evaluate eight research questions. Additional analyses were conducted using disaggregated data to determine if significance existed among subpopulations of bridge program and non-bridge participants.

Description of Analyzed Data

Data for the summer bridge participants and non-bridge participants were collected and anonymized by the research site's Office of Institutional Effectiveness, Research, and Planning. Incoming fall-semester freshmen were included in the dataset only if they qualified for TN Promise and tested at developmental level on at least one subject area of the institution's placement test. All identifying information was removed and participants were assigned random identification values. The data was provided in a Microsoft Excel file.

A power analysis was conducted to determine the required minimum sample size for research questions that required t-test and chi-square analyses. In addition to each statistical test, the alpha value or significance level and expected effect size were analyzed using Cohen's G*Power software program. An 80% power and a low effect size ($f^2 = .34$) was identified based on a meta-analysis of similar studies and resulted in a power analysis that determined minimum sample sizes of 137 and 136 for t-tests and chi-square analyses, respectively.

The summer bridge program participants for fall semesters 2015, 2016, 2017, 2018, and 2019 consisted of 223 students. However, the summer bridge participant sample used for this study was reduced to 206 to account for samples with missing data variables, such as earned credit hours or earned GPA. Two hundred and six (206) summer bridge program participants

attempted college-level ENGL 1010 and 116 summer bridge program participants attempted a college-level MATH course during their respective fall semester. MATH courses included MATH 1010, MATH 1030, MATH 1530, MATH 1710, MATH 1910, and ET 112. Differences in MATH courses are based on different program requirements for students' various majors. Overall, 17 of the original 223 participants were removed from the initial bridge program population and excluded from analysis due to insufficient data.

The non-bridge participants for fall semesters 2015 through 2019 consisted of 2,136 students. The nonparticipant sample was reduced to 1,801 students to account for missing data and to ensure that a sample would include all requisite variables, such as GPA, earned credit hours, race, and any other data necessary for this analysis. Additionally, the 1,801 non-bridge participants attempted ENGL 1010 in the fall semester, while 930 of this same group attempted a college-level MATH course. The selection of 1,801 non-bridge participants was used for random sampling to align with the paucity of participants who attempted a MATH course from the summer bridge sample. Therefore, prior to randomizing a nonparticipant sample for analysis, 335 students were removed from the initial population of 2,136 due to insufficient academic data.

A random sample was derived from the remaining 1,801 non-bridge participants. The random nonparticipant sample was established with the RAND function using Microsoft Excel version 2110, after which the randomized cell values were sorted from smallest to largest. The random sample used for analysis included 206 non-bridge participants who attempted ENGL 1010, including 95 non-bridge participants who attempted a college-level MATH course.

Participant Demographics

The summer bridge program and nonparticipant samples each consisted of 206 samples after the data was scrubbed to remove incomplete variables and the nonparticipant group was randomly sampled. All summer bridge participants and non-bridge participants were incoming college freshmen who applied and qualified for the TN Promise program. Similarly, all summer bridge participants and non-bridge participants tested at remedial level on one or more components of the college's placement test. Only placement-level incoming TN Promise freshmen qualified to enroll in a summer bridge program in the summer preceding their initial enrollment.

The summer bridge program participants consisted of 103 males and 103 females. The random non-bridge participants included 83 males and 123 females. As seen in Table 1, the total summer bridge program sample consisted of 28 participants in the 2015 cohort, 23 in 2016, 28 in 2017, 73 in 2018, and 54 in 2019. The random non-bridge program sample provided 57 participants from the 2015 cohort, 60 in 2016, 27 in 2017, 23 in 2018, and 39 in 2019. Participants from the summer bridge program sample matriculated through one of 46 different high schools prior to college enrollment. Participants from the non-bridge sample matriculated through one of 64 different high schools prior to college enrollment. The high volume of distinct high schools was an important counterweight to the single site nature of the bridge program. Thorough descriptions of demographic attributes related to ethnicity, income, and parental education are provided in the following sections in which underrepresented participants are distinguished from non-underrepresented participants.

Table 1

Bridge Participant and Non-Bridge Participant Attributes

Cohort Year	Bridge	Non-Bridge Participant
Fall 2015	28	57
Fall 2016	23	60
Fall 2017	28	27
Fall 2018	73	23
Fall 2019	54	39
Total	206	206

Table 2

Bridge Participant and Non-Bridge Participant Demographics

Demographic	Bridge	Non-Bridge Participant
Gender		
Male	103	83
Female	103	123
Total	206	206
Pell-Eligibility		
Pell-Eligible	106	119
Non-Pell	100	87
Total	206	206
First-Generation Status		
First Generation	51	64
Non-First Generation	155	142
Total	206	206

Note. This table displays the relevant categorical attributes of the summer bridge participant and nonparticipant samples, including first-generation and low-income signifiers.

Underrepresented Participant Data

Research questions 6, 7, and 8 relied on subsamples of underrepresented students within the summer bridge participant and nonparticipant samples. Underrepresented students were identified based on ethnicity, low-income as defined by Pell-eligibility based on Expected

Family Contribution (EFC), and first-generation status as indicated by student responses to parents' educational attainment. Participants were classified as underrepresented for the purposes of this research if their data included one or more of the underrepresented indicators. Participants in the bridge program participant and nonparticipant samples whose data did not indicate non-white ethnicity, low-income status as defined by Pell-eligibility, or first-generation status were not included in the underrepresented subsamples.

Ethnicity was derived from admissions information as self-identified by each student on admissions applications and categorized based on Tennessee Board of Regents classification. Non-white ethnicity categories included American Indian, Asian, Black or African American, Hispanic, Multiracial, and Native Hawaiian or Pacific Islander. Pell-eligibility was used to represent low-income status as it represents the threshold at which the United States Department of Education will subsidize students' educational costs with Pell Grants. The maximum Pell-eligible EFC typically increases each academic year, meaning that students can receive a higher EFC each subsequent FAFSA and qualify for Pell Grant. Therefore, participants were defined as low-income based on their respective cohort's maximum Pell-eligible EFC. The maximum Pell-eligible EFC for participants in the 2015 cohort was 5,198, while the maximum Pell-eligible EFC for participants in the 2019 cohort was 5,576. First-generation status required that participants indicate that both parents attained a high school education or less on the FAFSA. Participants were not classified as first-generation if they indicated that one or both parents attained a college degree or higher.

Underrepresented Summer Bridge Participant Data. Data derived from the summer bridge sample included 147 unduplicated participants who met one or more of the categorization requirements to qualify as underrepresented for the purposes of this study. Most summer bridge

program participants met the criteria to be considered underrepresented for the purposes of this study. One hundred and six (106) were classified as low-income based on Pell-eligibility, 51 were classified as first-generation based on their indication that neither parent had a college degree, and 85 were classified as non-White ethnicity based on their admissions application responses. As seen in Table 3, the bridge program sample included 1 American Indian, 5 Asian, 51 Black or African American, 22 Hispanic, and 6 Multiracial participants. The remaining 59 bridge program participants were excluded from analysis for research questions 6, 7, and 8 due to their lack of underrepresented status.

Underrepresented Non-Bridge Participant Data. Review of the nonparticipant sample of 206 students yielded 144 unduplicated students who were classified as underrepresented. Like the underrepresented bridge student sample, most sampled non-bridge participants qualified as underrepresented. One hundred nineteen (119) were classified as low-income based on Pell-eligibility, 64 were classified as first-generation based on their indication that neither parent had a college degree, and 63 were classified as non-White ethnicity based on their admissions application responses. As seen in Table 3, the nonparticipant sample included 36 Black or African American, 12 Hispanic, 14 Multiracial, and 1 Native Hawaiian or Pacific Islander participants. The remaining 62 non-bridge participants were excluded from analysis for research questions 6, 7, and 8 due to their lack of underrepresented status.

Table 3

Summer Bridge Participant and Non-Bridge Participant Demographics

Race/Ethnicity	Bridge	Non-Bridge Participant
American Indian	1	0
Asian	5	0
Black or African American	51	36
Hispanic	22	12

Multiracial	6	14
Native Hawaiian or Pac. Islander	0	1
White	121	143
Total	206	206

English and Mathematics Course Data

Research questions 4 and 5 involve outcomes in English and Mathematics classes based on the ubiquity of these courses among freshmen in their respective programs. Initial summer bridge program participant and nonparticipant samples were based on the availability of all demographic and academic data as well as a course GPA for ENGL 1010 from each cohort's fall semester. Therefore, each of the 206 summer bridge program participants and 206 non-bridge participants attempted and received a grade in ENGL 1010 in their first semester. However, Mathematics course requirements vary depending on program of study. One hundred sixteen (116) summer bridge program participants attempted either MATH 1010, MATH 1030, MATH 1530, MATH 1710, MATH 1910, or ET 112 and received grades in their first semester. 95 non-bridge participants attempted one of the preceding MATH courses in their first semester.

Analysis and Results

Research Question 1

Is there a significant difference in first-semester GPA between bridge program participants and non-bridge participants?

As seen in Table 4, an independent samples t-test comparing first-semester GPA mean scores of bridge program participants and non-bridge participants did not find a statistically significant difference ($t(410) = -.479$, $p > .05$) between the two groups. The strength of the relationship was small and accounted for less than 1% of the variability in the dependent variable ($\eta^2 < .001$). This analysis revealed that the mean score for the bridge program participants was slightly lower ($M = 2.5$, $SD = 1.23$, 95% CI = [2.3316, 2.6703]) than the mean of the non-bridge

participants (M = 2.56, SD = 1.26, 95% CI = [2.3863, 2.7333]). Bridge participants did not achieve a significantly higher first-semester GPA than non-bridge participants.

Research Question 2

Is there a significant difference in first-semester credit hour completion rates between bridge program participants and non-bridge participants?

As seen in Table 4, an independent samples t-test comparing first-semester credit hour completion rates of bridge program participants and non-bridge participants did not find a statistically significant difference ($t(410) = -.760$, $p > .05$) between the two groups. The strength of the relationship was small and accounted for less than 1% of the variability in the dependent variable ($\eta^2 < .001$). This analysis revealed that the mean credit hour completion rate for the bridge program participants was slightly lower (M = .709, SD = .345, 95% CI = [0.6616, 0.7563]) than the mean of the non-bridge participants (M = .735, SD = .351, 95% CI = [0.6868, 0.7831]). Bridge participants did not achieve a significantly higher credit hour completion rate than non-bridge participants.

Research Question 3

Is there a significant difference in fall-to-fall persistence rates between bridge program participants and non-bridge participants?

A chi-square analysis comparing the fall-to-fall persistence rates of bridge program participants and non-bridge participants did not find a statistically significant difference ($x^2(1, 412) = .01$, $p > .05$) between the two groups. The strength of the relationship was small and accounted for less than 1% of the variability in the dependent variable ($\eta^2 < .001$). Bridge program participants were slightly more likely to persist to the following fall semester. However, bridge participants did not achieve a significantly higher fall-to-fall persistence rate than non-bridge participants.

Research Question 4

Is there significant difference in first college-level Mathematics course GPA between bridge program participants and non-bridge participants?

The sample size for Research Question 4 did not meet the minimum threshold indicated by the power analysis conducted for this study. However, Table 4 presents the mean scores and standard deviations of first-semester semester mathematics course GPA of bridge program participants and non-bridge participants. The mean score for the non-bridge participants was slightly higher (M = 1.91, SD = 1.58, 95% CI = [1.5824, 2.2281]) than the mean of the bridge program participants (M = 1.72, SD = 1.59, 95% CI = [1.4216, 2.0094]).

Research Question 5

Is there a significant difference in first college-level English course GPA between bridge program participants and non-bridge participants?

As seen in Table 4, an independent samples t-test comparing first college-level English course GPA mean scores of bridge program participants and non-bridge participants did not find a statistically significant difference ($t(410) = -.869$, $p > .05$) between the two groups. The strength of the relationship was small and accounted for less than 1% of the variability in the dependent variable ($\eta^2 < .001$). This analysis revealed that the mean English course GPA for the bridge program participants (M = 1.99, SD = 1.51, 95% CI = [1.7827, 2.1978]) was slightly lower than the mean for the non-bridge participants (M = 2.12, SD = 1.55, 95% CI = [1.9086, 2.3342]). Bridge participants did not achieve a significantly higher first college-level English course GPA than non-bridge participants.

Table 4

GPA, Completion Rate, Mathematics, and English Course t-test Results

	Bridge		Non-Bridge Participant	
	M	SD	M	SD

GPA	2.5	1.23	2.56	1.26
Completion Rate	.709	.345	.735	.351

	Bridge		Non-Bridge Participant	
	M	SD	M	SD
MATH GPA	1.72	1.59	1.91	1.58

	Bridge		Non-Bridge Participant	
	M	SD	M	SD
ENGL GPA	1.99	1.51	2.12	1.55

Research Question 6

Is there a significant difference in first-semester GPA between underrepresented bridge program participants and underrepresented non-bridge participants?

As seen in Table 5, an independent samples t-test comparing first-semester GPA mean scores of underrepresented bridge program participants and underrepresented non-bridge participants did not find a statistically significant difference ($t(289) = -.440$, $p > .05$) between the two groups. The strength of the relationship was small and accounted for less than 1% of the variability in the dependent variable ($\eta^2 < .001$). This analysis revealed that the mean GPA for the underrepresented bridge program participants ($M = 2.39$, $SD = 1.27$, 95% CI = [2.1839, 2.5983]) was slightly lower than the mean for the underrepresented non-bridge participants ($M = 2.46$, $SD = 1.29$, 95% CI = [2.2451, 2.6691]). Underrepresented bridge participants did not achieve a significantly higher first-semester GPA than underrepresented non-bridge participants.

Research Question 7

Is there a significant difference in first-semester credit hour completion rates between underrepresented bridge program participants and underrepresented non-bridge participants?

As seen in Table 5, an independent samples t-test comparing first-semester credit hour completion rates of underrepresented bridge program participants and underrepresented non-bridge participants did not find a statistically significant difference ($t(289) = -.557$, $p > .05$) between the two groups. The strength of the relationship was small and accounted for less than

1% of the variability in the dependent variable ($\eta^2 < .001$). This analysis revealed that the first-semester credit hour completion rate for the underrepresented bridge program participants (M = .689, SD = .359, 95% CI = [0.6302, 0.7474]) was slightly lower than the credit hour completion rate for the underrepresented non-bridge participants (M = .712, SD = .363, 95% CI = [0.6525, 0.7722]). Underrepresented bridge participants did not achieve a significantly higher first-semester credit hour completion rate than underrepresented non-bridge participants.

Table 5

First-semester GPA and Completion Rate for Underrepresented Students

	URM Bridge		URM Non-Bridge Participants	
	M	SD	M	SD
GPA	2.39	1.27	2.46	1.29
Completion Rate	.689	.359	.712	.363

Research Question 8

Is there a significant difference in fall-to-fall persistence rates between underrepresented bridge program participants and underrepresented non-bridge participants?

A chi-square analysis comparing the fall-to-fall persistence rates of underrepresented bridge program participants and underrepresented non-bridge participants did not find a statistically significant difference $x^2(1, 291) = .15$, $p > .05$ between the two groups. The strength of the relationship was small and accounted for less than 1% of the variability in the dependent variable ($\eta^2 < .001$). More underrepresented bridge program participants persisted to the following fall semester than underrepresented non-bridge participants. However, underrepresented bridge participants did not achieve a significantly higher fall-to-fall persistence rate than underrepresented non-bridge participants.

Additional Analyses

Additional variables from bridge program participant and nonparticipant data were examined to determine if significant differences existed between first-semester GPA and first-semester credit completion rate between other subpopulations. In addition to low-income and first-generation statuses, which represent classifications that can be applied to any students regardless of other demographic characteristics such as ethnicity, analyses were conducted to examine differences among student genders.

Female/Male Summer Bridge Participants and Non-Bridge Participants

The sample sizes for analyses of female and male bridge program participants and non-bridge participants did not meet the minimum threshold indicated by the power analysis conducted for this study. However, Table 6 presents the mean scores and standard deviations of first-semester GPA and completion rate for female and male bridge program participants and non-bridge participants. The mean first-semester GPA score for female non-bridge participants was slightly higher (M = 2.74, SD = 1.16, 95% CI = [2.5376, 2.9513]) than scores for female bridge participants (M = 2.69, SD = 1.15, 95% CI = [2.4749, 2.9228]). Likewise, the mean first-semester credit hour completion rate for female non-bridge participants was slightly higher (M = .776, SD = .324, 95% CI = [.7176, .8334]) than the rate for female summer bridge program participants (M = .774, SD = .31, 95% CI = [.7134, .8346]).

Male bridge program participants and non-bridge program participants produced slightly different results when compared to their female counterparts. As seen in Table 6, the mean first-semester GPA score for male participants was slightly higher (M = 2.30, SD = 1.29, 95% CI = [2.0510, 2.5550]) than scores for male non-bridge participants (M = 2.29, SD = 1.36, 95% CI = [1.9881, 2.5842]). However, the mean first-semester credit hour completion rate for male non-

bridge participants was slightly higher (M = .675, SD = .380, 95% CI = [.5918, .7578]) than the rate for male summer bridge program participants (M = .644, SD = .366, 95% CI = [.5723, .7155].

Table 6

GPA and Completion Rates for Gender

	Female Bridge		Female Non-Bridge Participant	
	M	SD	M	SD
GPA	2.69	1.15	2.74	1.16
Completion Rate	.774	.31	.776	.324
	Male Bridge		Male Non-Bridge Participant	
	M	SD	M	SD
GPA	2.3	1.29	2.29	1.36
Completion Rate	.644	.366	.675	.38

Low-Income and First-Generation Summer Bridge Participants and Non-Bridge Participants

The sample sizes for analyses of low-income and first-generation bridge program participants and non-bridge participants did not meet the minimum threshold indicated by the power analysis conducted for this study. However, Table 7 presents the mean scores and standard deviations of first-semester GPA and completion rate for low-income and first-generation bridge program participants and non-bridge participants. The mean first-semester GPA score for low-income bridge participants was slightly higher (M = 2.42, SD = 1.21, 95% CI = [2.1898, 2.6540]) than scores for low-income non-bridge participants (M = 2.36, SD = 1.29, 95% CI = [2.1227, 2.5944]). The mean first-semester credit hour completion rate for low-income summer bridge program participants was slightly higher (M = .719, SD = .346, 95% CI = [.6525, .7858]) than the rate for low-income non-bridge participants (M = .686, SD = .369, 95% CI = [.6191, .7532]).

The mean first-semester GPA score of first-generation summer bridge program participants (M = 2.46, SD = 1.25, 95% CI = [2.1089, 2.8142]) was identical to that of first-generation non-bridge participants (M = 2.46, SD = 1.32, 95% CI = [2.1330, 2.7939]). Similarly, the first-semester credit hour completion rate of first-generation summer bridge program participants (M = .723, SD = .354, 95% CI = [.6231, .8224]) was almost identical to that of first-generation non-bridge participants (M = .722, SD = .369, 95% CI = [.6296, .8141]). Though no analysis could be conducted to evaluate statistical significance, the mean GPA scores and mean credit hour completion rates of first-generation summer bridge program participants and non-bridge participants were nearly identical.

Table 7

GPA and Completion Rates for Low-Income and First-Generation

	LI Bridge		LI Non-Bridge Participant	
	M	SD	M	SD
GPA	2.42	1.21	2.36	1.29
Completion Rate	.719	.346	.686	.369
	FG Bridge		FG Non-Bridge Participant	
	M	SD	M	SD
GPA	2.46	1.25	2.46	1.32
Completion Rate	.723	.354	.722	.369

Chapter 5. Summary, Conclusions, and Recommendations

This study compared the first-semester academic outcomes of developmental-level first-time college freshmen who completed a summer bridge program to the first-semester academic outcomes of similar students who did not complete a summer bridge program. Academic outcomes were measured as first-semester grade point average, credit hour completion rate, grade point average in Mathematics courses, grade point average in an English course, and fall-to-fall persistence. Similarly, data from underrepresented students were analyzed to examine differences in GPA, credit completion, and persistence. Underrepresented students were categorized based on non-White ethnicity, low-income status as defined by Pell Grant eligibility, or first-generation status as indicated by participants' FAFSAs.

All eight research questions were analyzed using IBM Statistical Package for Social Sciences (SPSS). Independent samples t-tests were used to analyze questions 1, 2, 4, 5, 6, and 7. Chi-square tests were used to analyze questions 3 and 8.

Summary of Findings

Research Question 1 examined first-semester GPA for summer bridge program participants and non-bridge participants. First-semester GPA is an important indicator of persistence and success, and a low first-semester GPA and subsequent academic probation has been found to represent a statistically significant factor in the six-year graduation rates of underrepresented students (Gershenfeld et al., 2016). Results from the analysis of Research Question 1 did not find a statistically significant difference in first-semester GPA for bridge students and non-bridge participants ($p > .05$). The mean first-semester GPA for bridge students was 2.5 and the mean first-semester GPA for non-bridge participants was 2.56. Non-bridge participants slightly outperformed students who completed the summer bridge program. Cabrera

et al. (2013) analyzed performance data from participants in the University of Arizona's New Start Summer Program and found a statistically significant, positive correlation between program completion and first-year GPA and retention, though this statistically significant predictor became non-significant when controlling for students' other first-year college experiences.

Analysis of Research Question 2 did not yield a statistically significant difference between first-semester credit completion rates for bridge students and non-bridge participants ($p > .05$). The mean credit hour completion rate for bridge program participants was 71% ($M = .709$) and 74% ($M = .735$) for non-bridge participants. As in Research Question 1, the non-bridge participants slightly outperformed bridge program participants. Results from previous literature exhibits mixed results as to the efficacy of various bridge programs on credit completion rates. Barnett et al. (2012) examined eight developmental summer bridge programs in Texas and likewise found that program completion had no significant effect on credit hour completion. Wachen et al. (2016) examined outcomes from a University of North Carolina Summer Bridge program and found that participants earned 53 college-level credits compared to 44 credits earned by control group students. Wathington et al. (2016) examined the same eight bridge programs in Texas and also found no significant benefits to credit hour completion for bridge program participants. Douglas and Attewell (2014a) examined outcomes from a summer bridge program in which bridge program students achieved a 5.4% greater credit hour completion rate than their non-bridge peers. Despite this positive correlation between bridge participation and credit hour completion rates, Douglas and Attewell (2014a) acknowledged that other findings of bridge program analyses produced mixed results that tempered the presumed benefits that their research indicated.

Research Question 3 analyzed fall-to-fall persistence rates of summer bridge program participants and non-bridge participants. According to Tinto (2017), persistence or retention are closely related to students' motivations, which are in turn influenced by academic and social capacities. Summer bridge programs can serve as strategies to deliver developmental education and increase rates of persistence (Nunez & Elizonda, 2013). Results from this chi-square analysis did not find statistically significant differences in persistence rates between bridge students and non-bridge participants ($p > .05$). There was almost no difference in the fall-to-fall enrollment rates as 122 of 206 bridge students persisted relative to 121 of 206 non-bridge participants who persisted. Results from this analysis indicated almost identical rates of persistence among both groups of students. In a finding that resembles the results of this study, Barnett et al. (2012) found that control group students persisted for slightly more semesters, without statistical significance, than students who completed one of eight developmental summer bridge programs in Texas. Wathington et al. (2016) likewise found no significant advantages in persistence rates among bridge program students relative to their control group peers, though bridge program students attempted slightly more and successfully completed the same number of credit hours. Contrary to this finding, previous literature provides examples in which bridge program participants achieved significantly higher rates of persistence than non-bridge participants (Cabrera et al., 2013; Wachen et al., 2018). Similarly, Bir and Myrick (2015) found that bridge program participants achieved significantly higher fall-to-fall persistence rates than non-bridge participants in both their first and second years of college.

Research Question 4 analyzed first college-level Mathematics course GPA, although the samples fell short of the minimum t-test sample size of 137 as indicated by a power analysis. Unlike the uniformity of English courses provided by Research Question 5, participants

attempted one of six different, but comparable, Mathematics prerequisites determined by their program of study. There was no significant difference between bridge program participants and non-bridge participants ($p > .05$). The mean first college-level MATH course GPA was 1.72 for bridge students and 1.91 for non-bridge participants. Kallison and Stadler (2012) analyzed post-bridge program placement test scores and similarly found no significant difference resulting from bridge program participation among data analyzed from four colleges. Likewise, Chingos et al. (2017) analyzed student outcomes following a low-cost online Mathematics bridge program and did not find statistically significant improvements in GPA or credit accumulation for participants. Cancado et al. (2018) found similarly inconclusive results following a Mathematics-focused bridge program that did not produce statistically significant program retention or graduation rates among bridge participants. However, Barnett et al. (2012) found that bridge program participants passed their first college-level mathematics courses at higher rates than their control group peers, though the statistical significance of these differences dissipated by the end of the two-year study period. Frost and Dreher (2017) found that students who completed a four-week online summer mathematics bridge program successfully passed College Algebra at a higher rate than other students attempting that course in the same semester. Wathington et al. (2016) found that 10.7% of summer bridge program participants benefited from a 5.9% advantage in first college-level math pass rates in the fall semester after program participation compared to a control group, and that advantage increased to a 9.4% advantage in the following spring semester.

Research Question 5 examined academic performance in first college-level English courses as measured by student GPA. Analysis of first college-level English course GPAs did not find a statistically significant difference between summer bridge program participants and

non-bridge participants ($p > .05$). The mean English course GPA for bridge students was 1.99 and the mean English course GPA for non-bridge participants was 2.12. This result is like that described by Wathington et al. (2016) wherein developmental-level freshmen received little to no benefit in their first college-level writing and reading courses following the completion of a summer bridge program. Barnett et al. (2012) likewise did not find significant improvements in completion rates of first college-level reading courses for bridge program students compared to control group students, though bridge students did achieve significantly higher pass rates in math and writing courses. Though the content and purpose of the bridge program examined in this study are more expansive, Kodama et al. (2018) analyzed academic outcomes after participation in a summer bridge writing program and found that bridge students achieved a significantly higher grade in their first writing course and a significantly higher first-year GPA compared to control group students.

Research Question 6 analyzed first-semester GPAs of underrepresented summer bridge students and underrepresented non-bridge participants. Previous research has examined pre-enrollment program participation and other predictors of academic success for ethnically non-White and low-income students. Gershenfeld et al. (2016) analyzed 1,947 university freshmen and found that first-semester GPA is a statistically significant early predictor of college graduation and possible academic probation for underrepresented students. Cabrera et al. (2013) examined NSSP participants and found that the strongest predictor of first-year academic performance was high school GPA, and underrepresented minority and Pell Grant-eligible students had lower first-year GPAs than other students. This research aligns with the findings of this study in which underrepresented students produced a lower mean GPA and completion rate than the overall sample of bridge participants. However, there was no statistically significant

difference in the first-semester GPAs of summer bridge participants and non-bridge participants across all cohorts ($p > .05$). The mean GPA for underrepresented bridge program students was 2.39 and the mean GPA for underrepresented non-bridge participants was 2.46. This result is contrary to previous findings that indicated statistically significant gains in GPAs among developmental-level African American bridge program participants compared to non-bridge participants, though performance gains were exhibited only by African American female students (Bir & Myrick, 2015). Greer et al. (2020) found that summer bridge program participation was not a significant predictor of GPA for low-income bridge program participants, though this study did not evaluate outcomes for other categories of underrepresentation.

Research Question 7 analyzed first-semester credit hour completion rates of underrepresented summer bridge students and underrepresented non-bridge participants. There was no statistically significant difference in first-semester credit hour completion rates of underrepresented bridge students and underrepresented non-bridge participants ($p > .05$). The mean credit hour completion rate for underrepresented summer bridge students was 69% ($M = .689$) and 71% ($M = .712$) for underrepresented non-bridge participants. This finding does not resemble the research of Quiroz and Garza (2018), which found statistically significance in higher pass rates of first-year Hispanic bridge program participants relative to their Hispanic control group peers. Contrarily, Kodama et al. (2018) found that summer writing bridge program participation was a positive, significant predictor of first-year credit accumulation and first-year GPA for participants, but a regression analysis indicated that being African American and Latino resulted in a negative influence on some of the outcomes. Likewise, Kodama et al. (2018) found that first-generation and Pell-eligible bridge participants only received statistically significant benefits related to 4-year graduation and retention, but not necessarily credit hour completion.

Research Question 8 analyzed fall-to-fall persistence of underrepresented summer bridge program participants and underrepresented non-bridge participants. According to Tinto (2017), underrepresented students, particularly low-income students who have experienced limited resources, might have different perceptions and motivations related to postsecondary enrollment and thus present differently compared to their traditionally served peers. However, results from a chi-square analysis did not identify statistically significant differences in fall-to-fall persistence of underrepresented bridge students and underrepresented non-bridge participants ($p > .05$). Eighty-seven (87) out of 147 underrepresented bridge program students persisted in the following fall semester compared to 82 out of 144 underrepresented non-bridge participants who persisted in the following fall semester. Unlike the results of this study, Bir and Myrick (2015) found that African American students at an HBCU who completed an intense summer bridge program experienced higher retention rates than their non-bridge peers despite lower academic profiles as incoming freshmen.

Additional analyses were conducted beyond the eight research questions to examine other sample variables. Though there was no statistically significant result found in the analysis of low-income summer bridge participants and low-income non-bridge participants, students who completed a summer bridge program prior to enrollment achieved higher GPA and credit hour completion rates than their nonparticipant peers. Low-income bridge students earned a mean first-semester GPA of 2.42 compared to a mean GPA of 2.36 for low-income non-bridge participants. Likewise, low-income bridge students completed 72% of their first-semester credits compared to 69% for low-income non-bridge participants. These results were not statistically significant, but they represented a divergence from most other analyses in which non-bridge participants consistently, though not significantly, outperformed summer bridge participants.

Greer et al. (2020) found similar mixed results for low-income bridge program participation in which low-income bridge students were more likely to graduate but were not more likely to achieve higher GPAs than their low-income non-bridge peers.

First-generation bridge program participants (M = .723) achieved slightly higher first-semester credit completion rates than first-generation non-bridge participants (M = .722), though these results were not statistically significant. Tomasko et al. (2016) found statistically significant gains in program retention for underrepresented minority and female students following the completion of a STEM bridge program but did not find statistical significance for first-generation STEM bridge program participants. This specific student attribute might require specialized bridge programming beyond academic content to produce benefits for participants.

Recommendations for Practice and Policy Makers

The results from this study did not produce statistically significant differences between summer bridge program participants and non-bridge participants. Existing literature indicates mixed results from the implementation of myriad bridge program formats, and this study reflects the ambiguity of student outcomes following the completion of a summer bridge program. As with all bridge program designs and participant populations, such positive effects might be attributable to variations in program participants, program purpose, demographics, or administrators. Regardless of the purpose and target population of future bridge programs, Slade et al. (2015) identified academic rigor and engagement, attention to affective needs, and acculturation to college life as three components of success bridge program design.

Bridge Program Population Focus

Policymakers and practitioners should focus efforts on remediating and inculcating targeted groups of students rather than generalized definitions of at-risk populations, such as

students entering developmental coursework. Future bridge programs might better serve narrow, specific student populations based on their needs, as evidenced by previous research. Distinct populations of college students, including underrepresented minorities, low-income, first-generation, STEM students, ESL students, and nontraditional students, have various background attributes that might make them more or less responsive to certain program designs and purposes. Statistically significant positive outcomes of summer bridge program implementation appear to be contextual and possibly conditioned on the audience served by each bridge program. Some analyses present statistically significant academic gains in GPA, course pass rates, persistence rates, and graduation rates, including generalized bridge programs and programs tailored to specific student populations (Cabrera et al., 2013; Douglas & Attewell, 2014b; Kodama et al., 2018; Quiroz & Garza, 2018). Additionally, some bridge programs have exhibited successful outcomes in narrow scopes or for limited populations, such as improvements in placement test scores (Cancado et al., 2018; Frost & Dreher, 2017). A meta-analysis of 16 university STEM summer bridge programs demonstrated a medium-sized effect on first-year GPA for participants (Bradford, 2021). Bridge program content might be delivered more effectively to more focused student populations rather than generalized groups of students defined by academic preparation or first-year status.

Increase Bridge Program Accessibility

Practitioners should use recyclable, cost-effective technology, such as online modalities and tutoring and video software, to expand availability of bridge programs to students who might otherwise lack the resources or support to participate. Barriers such as program cost, motivation, and self-selection must be addressed in any format or modality of summer bridge program design. Lopez (2016) found that historically disadvantaged summer bridge students at a large

community college in southern California reported that they would not have been able to participate if the college had not covered the program costs. St. John et al. (2014) indicated that the selection process of a summer bridge program for in-state underrepresented students was expanded to include out-of-state students to sustain funding for the program. Frost and Dreher (2017) examined an online summer mathematics bridge program and found that, though there was evidence that bridge participants demonstrated significantly higher placement test scores and a higher pass rate in their first college-level mathematics course, there were concerns about participation rates, student and parent motivation, and deficits in academic advising related to bridge program availability. The costs of participation in the bridge program examined by this study were covered by a grant, but a participation rate of less than 10% of eligible students suggests that student or parent motivation or availability limited their engagement.

Continued Engagement

Policymakers and practitioners should extend bridge program provisions and goals beyond the entry point and continue to provide comparable supports to participants throughout their enrollment. An extension of bridge program activities beyond the summer and first year is a valuable aspect of bridge program design that ensures a continuation of whatever gains students achieve as well as opportunities to collect and analyze additional data regarding the efficacy of bridge program design and other academic and support structures available at the college. Lane et al. (2017) reported that a STEM summer bridge program for underserved students provided administrators with opportunities to identify individual needs of participants that could be addressed later in the academic year. Slade et al. (2015) analyzed a comprehensive summer bridge program at an HBCU and acknowledged that a lack of funding resulted in an inability to continue services and activities provided by the bridge program. Similarly, St. John et al. (2014)

analyzed a bridge program designed for engineering students and indicated that bridge program offerings are merely singular components of a comprehensive strategy to continuously support students. Cabrera et al. (2013) indicated that, though summer bridge program participation significantly predicted first-year GPA and retention, these findings could not be solely attributed to bridge program participation due to myriad academic and social support systems provided to bridge students throughout the academic year. Such research suggests that bridge programs can serve as gateways or supplementary provisions to ensure that students are consistently, continuously developed. Continued tracking and engagement of participants could extend the academic and social gains made by these students during the tenure of the bridge program.

Non-Academic Bridge Program Designs

Policymakers should examine the utility of specialized non-academic bridge programs rather than broad curriculum-focused programs. Alternative forms of summer bridge programs intended to inculcate college and life skills might provide more benefits to at-risk student populations, including underrepresented, low-income, first-generation, and developmental-level students. Postsecondary integration is an important aspect of Tinto's theory of student departure, and bridge programs that assist students with the transition from prior communities to a college community would not necessarily focus on the rehabilitation or development of academic performance. Wilson and Lowry (2017) found that 23 academically underprepared Black or African American and Hispanic or Latino freshmen reported high rates of positive feedback regarding academic performance, self-confidence, course-scheduling, and active engagement following the completion of a summer bridge program. Similarly, Tomasko et al. (2016) recommended that college bridge programs should focus on multiple dimensions of the student rather than only academic coursework to improve rates of belongingness and social integration.

Cooper et al. (2017) examined a two-week summer bridge program focused on active-learning biology content and found that bridge participants reported higher rates of learning gains from active learning exercises and a higher awareness of learning strategies when engaged in active learning in introductory biology coursework. Hoops and Kutrybala (2015) found that nontraditional summer bridge participants reported higher rates of self-reported gains in personal and affective growth compared to academic growth, and most participants attributed this growth to interactions with instructors rather than program content. Specialized bridge programs might produce various qualitative improvements in student engagement that are not necessarily measured in academic outputs.

Recommendations for Future Research

Focus on Target Populations

Future evaluations of bridge program design and outcomes should focus on how specific, disaggregated populations benefit from targeted bridge programs. The research presented in this study indicated a need for increased granularity when analyzing subpopulations within a group of academically underprepared students. Rather than analyzing first-semester output from all students following the implementation of an academic-focused bridge program, researchers can examine the performance of students from low-performing high schools, first-generation students, or ESL students and their development of study skills or inculcation into the postsecondary environment. High-performing students from disadvantaged backgrounds might benefit from bridge programs that introduce them to college life, establish interactions and relationships with faculty, and connect them to college resources, all of which can strengthen integration and sustain enrollment.

Modality Comparison

Evaluate open-ended online or hybrid bridge programming that is accessible to students throughout the summer following their graduation from high school to allow more students to participate. This study analyzed 206 bridge program participants and 206 non-bridge participants. However, there were 2,136 first-time freshmen in the control population from 2015 to 2019 who qualified to participate in this summer bridge program and did not enroll. With an increased availability of online programs, analysis within an online bridge program and between online and on-ground modalities would benefit future research to determine if different modalities are more effective at reaching students or more efficacious in producing measurable outcomes of participants.

Qualitative Analysis

Include surveys and qualitative analysis following bridge program completion when possible. Douglas and Attewell (2014a) recommend qualitative analysis to collect information about the lived experiences of bridge program participants to further explore the efficacy of these programs. Quantitative metrics that measure academic performance might fail to illustrate that bridge program participation assists students in avoiding counterfactual results in which they achieve lesser outcomes, such as lower persistence and matriculation rates. Qualitative analysis of surveys might yield indications that summer bridge programs provided students with self-confidence, study skills, support networks, and advising that contributed to their academic performance in ways that are not reflected by statistically significant findings. Grace-Odeleye and Santiago (2019) critiqued some current bridge program research for a lack of analysis of non-intervention influences on students' resilience and persistence. Such results cannot be discerned from anonymized academic records.

Cost-Benefit Analysis

Include program costs in future evaluation of summer bridge program efficacy. Regardless of the modality or content of bridge programs, the financial and human resource costs are important factors to consider in the examination of student outcomes. TN Achieves, agency that funded the bridge programs examined in this study, declined to share grant award amounts for this research. Future research should account for a cost-benefit analysis to determine if expenditures could be repurposed to comparably priced student interventions, such as tutoring, specialized advising, transportation, or other student activities. For example, Barnett et al. (2012) evaluated overall program costs and determined that bridge program participants at one of eight summer bridge programs in Texas would have needed to earn 3.8 additional college-level credits on average for the program to realize its overall costs and expenditures. An account of student perceptions resulting from qualitative analysis can help inform the sustainability of a bridge program when funding is a concern.

Sampling

Perform matched sampling between bridge program participants and non-bridge participants rather than random sampling. The summer bridge population in this study was inadequate for some variations of sampling and analysis, but future research on larger bridge program interventions can control for the effects, if any, that bridge participation has on students. Power analyses indicated adequate sample sizes for the analysis in this study. However, a larger population would provide opportunities to closely match control and treatment samples and produce more refined data.

Population Selection

Expand or refine the standards of population selection. This study relied on data from bridge program participation that was contingent on academic deficits as defined by college placement test scores. More open-ended bridge programs can yield participants and non-bridge participants whose inclusion in analysis might be based on high school grade point average, ACT or SAT scores, or other secondary school performance metrics. As suggested by Scott-Clayton and Rodriguez (2015), placement test scores might fail to sufficiently delineate between students in need of academic remediation because such tests fail to capture variations that exist at the thresholds of academic preparedness and unpreparedness. Alternative measures of college readiness might provide a more useful baseline in future examinations of bridge participant outcomes and program utility.

Additional Non-Bridge Influences

Analysis of other interventions and programmatic offerings should be included in more comprehensive studies of summer bridge program efficacy. Student support services, advising, tutoring, and financial aid provisions are institutional opportunities that might enhance or detract from summer bridge programs. Similarly, Douglas and Attewell (2014a) recommend that future research consider the quality of bridge program instruction and the structure of placement testing and remedial coursework. Future research might identify efforts at remediation and other forms of academic support which confound summer bridge program progress. Alternatively, other analyses might identify non-academic support that extends the immediate benefits of bridge program participation. Only expanded, holistic research beyond the scope of this study can account for these other factors.

Additional Outcomes

Analyze academic outcomes from future semesters and evaluate additional types of academic outcomes and data. This study was confined to the examination of first-semester or first-year academic outcomes, including fall-to-fall persistence, to evaluate the immediate effects that summer bridge program participation would have on academically underprepared students. Douglas and Attewell (2014a) noted that research from Barnet et al. (2012) and Wathington et al. (2011) did not examine data beyond the first two years of bridge participants' enrollment. Though extended studies would vary based on the length of the terminal degree program at study sites, such analysis might yield long-term gains in persistence and degree completion for bridge program participants. Additional data, such as academic performance data from future semesters, financial aid retention, transfer rates, graduation rates, and participation in student activities and organizations, might provide a more comprehensive evaluation of the efficacy of similar summer bridge programs.

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