A LOGISTIC REGRESSION ANALYSIS OF STUDENT EXPERIENCE FACTORS FOR THE

ENHANCEMENT OF DEVELOPMENTAL POST-SECONDARY RETENTION

INITIATIVES

by

Michael Thomas Shenkle

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

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ABSTRACT

In response to stagnant undergraduate completion rates and growing demands for post-secondary accountability, institutions are actively pursuing effective, broadly applicable methods for promoting student success. One notable scarcity in existing research is found in the tailoring of broad academic interventions to better meet the specific needs of students from known risk populations. The purpose of this correlational study was to investigate possible predictive relationships among three specific pre-matriculation characteristics (gender, ethnicity and secondary school type) and subsequent academic year retention for residential undergraduate students that completed a developmental education course at a private, liberal arts university. A logistic regression was conducted to examine predictive relationships between these factors for the purpose of establishing the need for more data-based intervention strategies. Student archival data of 1,505 residential undergraduate students at a private, liberal arts university was collected from the institution's database, and included demographic and enrollment data for identifying retention or attrition among students. Analysis revealed that neither the gender nor ethnicity models produced statistically significant predictive relationships in contrast with U.S. national enrollment trends, though two specific ethnicities, African American and Caucasian were significant. Secondary school type showed a significant predictive relationship in favor of private school students in predicting a positive enrollment response to developmental coursework. These results provide insight into the usefulness of traditional risk factors when applied to the intervention process, as well as meaningful data for the population-specific evaluation of the developmental coursework in terms of promoting year-to-year retention.

   Keywords: retention, attrition, pre-matriculation, persistence, developmental education, intervention, predictive analytics

Dedication

This dissertation is dedicated to family. First to my wife Nina, who has graciously shared me with a computer far more than anyone should be asked to. I cannot reasonably thank her enough for the love, support, motivation and strength she has provided to me and our family throughout this process. My academic and professional accomplishments are of her making, and I am sincerely thankful for the grace she represents and adds to my life. I dedicate this also to my beloved children, for whom I hope daily for a love of knowledge and wisdom. I pray the completion of this work will inspire them to accomplish the work the Lord has placed in their hearts.

I also dedicate this work to my parents, who endlessly sacrificed to give me every opportunity in life. This dissertation was completed on the wisdom of their greatest lessons, and I am grateful for their continual inspiration. Finally, to my siblings, who always embellished my strengths and supported my endeavors. I am in debt for each of their unique contributions.

"Please believe there is no love that's worth sharing like the love that let us share our name."

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The first acknowledgement belongs solely to Jesus Christ, who has endowed me with every good and every perfect gift in my life. "For by grace you have been saved through faith. And this is not your own doing; it is the gift of God." – Ephesians 2:8, ESV

I would also like to acknowledge my committee and their dedicated work on my behalf. First to Dr. Ellen Lowrie Black, who has been a consummate professional, mentor and teacher. This endeavor would have long remained in its infancy without her influence. I would like to thank her for a lifetime of dedication to young leaders everywhere, and her personal influence in my life.

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Department of Education (DOE)

Integrated Postsecondary Education Data System (IPEDS)

National Center for Education Statistics (NCES)

Socioeconomic Status (SES)

United States (U.S.)

CHAPTER ONE: INTRODUCTION

Overview

Undergraduate student retention is a priority research topic for various stakeholders in higher education, and a primary area of emphasis for the United States Department of Education. The following sections detail several relevant historical, societal and theoretical considerations in undergraduate retention studies. The premise for this correlational research study is also provided, with emphasis on the significance of data-based undergraduate student retention research.

Background

In response to stagnant undergraduate completion rates and growing demands for post-secondary accountability, institutions, governmental agencies and corporations are actively pursuing effective, broadly applicable methods for promoting collegiate student success. In the United States, post-secondary completion rates reflect the yield on an incalculable multi-generational investment: one maintained by students, taxpayers and the Federal government for the hope of a more opportune future (Raisman, 2011). This hope would appear well placed, as post-secondary completion has correlated positively with employment rates, lifetime earnings, civil participation and crime aversion on a consistent basis over the last four decades (Kyllonen, 2012). Still, student attrition remains a significant barrier to the realization of the nation's degree attainment initiatives, and threatens the collective return on an immense investment for all parties. With the national graduation rate stalled at just over sixty percent (Shapiro et al., 2012) and Title IV aid growing at an unsustainable pace (CollegeBoard, 2012), collegiate stakeholders are reasonably concerned about the long-term viability of the higher education machine (Lapovsky, 2014). Institutions have responded with significant investments in student retention

initiatives and a commitment to the research field of post-secondary persistence; however

tangible best practices have been slow to materialize (Kalsbeek & Hossler, 2010).

Historical Context

Concerns over post-secondary completion have long accompanied the modern college

system. Informally, the Federal government began examining the effectiveness of the traditional

post-secondary model during the Great Depression, most notably in John McNeely's (1937)

report for the U.S. Department of the Interior. Researchers and theorists have routinely

questioned the appropriateness of the four-year residential model itself over the last century due

to concerns over student attrition rates (Demetriou & Schmitz-Sciborski, 2011; Engle & Tinto,

2008; Kamens, 1971). After the creation of the National Youth Administration and the passage

of the Serviceman's Readjustment Act of 1944 (informally the G.I. Bill), American higher

education saw a boom in new enrollment, but a continued drop-off in degree attainment rates as

university's struggled to adapt to the needs of the increasingly diverse student populous (Berger

et al., 2012). During this era, theorists questioned the congruence between the rigors of college

and the personalities of those attending (Berger et al., 2012)

As the study of collegiate student success gained momentum behind the social science

fueled 1970's, observable trends led to the emergence of the field's first palpable theories.

Kamens (1971) resumed the work of earlier practitioners in questioning the size and complexity

of the American higher education model, citing non-completion as an indicator of institutional

failure rather than a product of learner inadequacy. Conversely, Tinto (1975) contributed a

seminal work on student retention in his Student Engagement Theory, which asserted that

students' engagement in the college experience was the single greatest contributing factor to

their persistence. Building from this premise, Astin's (1977) Involvement Theory postulated a

direct correlation between students' total involvement in institutional activities and their ultimate

persistence, while considering demographic factors such as age, gender and distance from the

institution (Reason, 2009). Finally, Bean (1980) argued that a student's ability to persist relied

heavily upon pre-matriculation experience factors, which could combine to create varying

elements of "risk."

While these theories were refined and tested throughout the following two decades,

progress in field of student retention remained largely philosophical until the field was equipped

to evolve through advanced analytics and informed predictive modeling (Delen, 2010). Aided

by the informational requirements of Federal Financial Aid and the transcendence of institutional

data, the identification of students considered to be at-risk for degree non-completion became

realistic through various predictive models that examined characteristics of previously

unsuccessful students (Baer & Duin, 2014). In this application, "at-risk" is defined as students

who have a statistically low probability of degree completion based on their shared

characteristics with previously unsuccessful students (Davis & Burgher, 2013).

The resulting research field of undergraduate student retention centers around two

primary facets: the identification of at-risk students, and intervention methods to assist various

student populations in persisting to degree completion (Angelopulo, 2013). Though broad,

theory-based intervention work dominated the early decades of formalized retention research,

identification initiatives vaulted to the administrative spotlight as technological capabilities

provided inroads to increasingly accurate prediction (Davis & Burgher, 2013). As the paradigm

shifted throughout the early 2000's, intervention strategies became comparably less dynamic;

disregarding unique student characteristics and increasingly relying upon a "one-size-fits-all"

approach (Adams, 2011). As a result, the relative impotency of intervention strategies coupled

with ever-broadening applications for identification methods has left the student retention

enigma largely unsolved, though more narrowly focused.

Societal Context

Student success rates at the college level hold significant implications for society,

specifically as they relate to students, institutions and the national economy. Students, perhaps

more proximately than all other stakeholders, bear a significant financial handicap for non-

completion. In addition to a well-documented decrease in lifetime earnings, employment

opportunities and overall health, as well as increases in incarceration rates, students must

overcome student debt without the benefit of an earned degree (Raisman, 2011). The U.S.

Department of Education (2015) reports that students who attend college but do not obtain a

degree enter student loan default at a rate three times of their degree-earning counterparts: a

statistic that aptly frames the urgency of student retention initiatives (Kyllonen, 2012).

For institutions, student attrition threatens the health of the organization in terms of

revenue and ratings (Turner & Thompson, 2014). Student attrition not only deprives an

institution of direct returns in the form of tuition and fees, but also requires additional

expenditures in recruitment and admissions in order to replace each departed student (Raisman,

2011). The latter, which can be far more damaging to the long-term success of the institution, is

reflected in published completion rates, which are provided to each student via a plethora of

annual publications and federal reports.

Student completion rates also hold direct implications for the health of a nation. The

American Institute for Research (2010) provides data to suggest that more than 1.3 billion dollars

in federal funds are disbursed annually for students that do not attend college beyond their first

year (O'Keeffe, 2015). Similarly, diminished earnings directly translate to decreased tax

revenue and greater frequency of government assistance, which, when coupled with increased rates of incarceration and Federal student loan default represents a burgeoning national crisis. President Barack Obama specifically identified the U.S.'s rate of degree attainment as a direct threat to the country's position as a world economic leader (American Institute for Research 2010; Talbert 2012): a statement validated by the U.S.'s possession of the lowest completion rates of all industrialized countries (O'Keeffe, 2015).

Finally, undergraduate degree completion rates remains a lopsided outcome for several key demographics in the United States. The U.S. Department of Education's National Center for Education Statistics (2016) has long noted a significant lag in post-secondary persistence among males versus their female counterparts; a disparity that averaged 9.1 percentage points between 2000 and 2012. This trend mirrors research conducted in the United Kingdom, where the completion rate differential was observed to confound even pre-entry characteristics of students such as GPA and socioeconomic status (SES) (Barrow, Reilly, & Woolfield, 2015). Similarly, program completion rates varied greatly by ethnicity across the same span, with African-American students reporting attrition rates more than double their Caucasian counterparts (National Center for Education Statistics, 2016). In addition to the direct ramifications of non-completion listed above, the disparity between these populations threatens to perpetuate social inequities for the foreseeable future.

Theoretical Context

Despite the focus of modern research, student retention issues extend well beyond questions of simple identification of, and intervention for, at-risk students. Tinto's (1975) work with Student Engagement Theory remains an important foundational study and is considered among the more practical co-curricular approaches for promoting student retention. As Tinto

initially theorized and later developed, students who show increased engagement in the affairs of the institution tend to retain at a statistically greater rate than those who show weaker patterns of engagement. Raisman (2011) later suggested that Tinto's Engagement Theory also extends to the reciprocal perception of engagement: that is, whether or not the institution is engaged with the student.

From an academic perspective, Bandura's (1977) Social Learning Theory can be used to frame the issue of academic-based non-completion, and speaks to a possible solution through environmental intervention. In recognizing the social aspect of successful educational behavior, that is, successful course and degree completion, the concept of cohort-based academic intervention holds promise for improved intrinsic motivation (Fritz, 2011). Coupled with the results achieved through the application of goal-setting theory in mentoring coursework (Sorrentino, 2007), academic intervention in the form of developmental coursework holds significant theoretical value for promoting successful academic behavior.

Finally, Bean (1980) theorized that a student's unique background played a central role in determining their interaction with a college or university, including secondary school experiences, SES and home structure. Bean's work combined with Tinto's engagement premise to formulate much of the construct of modern day retention analytics (Demetriou & Schmitz-Sciborski, 2011). Of particular interest to this study is the role of past educational experiences in determining how students respond to a given intervention: in this case, one of two developmental course types. In this regard, Bean's work serves as the primary theoretical framework for this research.

The theoretical framework for this study is equally predicated on established educational practices and prevalent retention theories such as Tinto and Bean's models. As an aggregate, the

study's construct aims not to affirm the theories themselves, but to assess the compatibility of the theories in the context of the joint model that modern retention research has assimilated to. By assessing population-specific learning needs in developmental coursework, institutions can broaden the scope of their intervention approach. In summary, the evolution of undergraduate student retention has largely followed societal trends, market demand and the progression of student data. As the onus of persistence shifted from the student to the institution in the mid 1900's, research began to supplement burgeoning theories such as Tinto's (1975) engagement theory and Bean's (1980) contextually based student experience theory to create the field's early intervention practices. As the information age hastened the aggregation of student data in the early 2000's, predictive analytics used for the identification of at-risk students slowly began to supplant intervention research as a primary focus of retention divisions. Despite notable gains, the field is still bereft of widely-accepted best practices, and has been slow to apply the insight gained through at-risk identification efforts to the intervention process.

Problem Statement

Prior research has adequately addressed the marginal effectiveness of common identification and intervention approaches in college student retention; however, scalable best practices have been considerably slow to develop (Maher & Macallister, 2013). For each mark of success, such as the theoretical validity found across the seminal retention theories of Tinto (1975), Bandura (1977) and Bean (1980), the complexity of the student as an individual serves as a significant confounding variable, and has limited the effectiveness of broad intervention strategies as a result. Though the insight and predictive power of advanced analytics do address this complexity, the practice has been underutilized in intervention initiatives, often extending no further than initial at-risk identification (Delen, 2010).

Prior studies clearly promote the use of academic interventions such as developmental coursework to encourage the retention of general populations; however, meaningful analysis between individual student characteristics and successful intervention approaches remain under-researched (Fontaine, 2014; Meling, Mundy, Kupczynski, & Green, 2013). Despite many practitioner's success in tailoring intervention strategies to specific populations, these methods still rely on the assumption that all members of a subpopulation will respond to the treatment in a similar way, or that their group membership is predicated on a similar characteristic (Adams, 2011). Applied specifically to students who are struggling academically, students are commonly introduced to a single, broad intervention in the form of developmental coursework (classes aimed at supplementing an academic deficiency) regardless of their unique academic history and specific needs, and irrespective of the cause of their academic shortcomings (Adams, 2011).

The development of methods to identify at-risk students (those likely to disenroll prior to earning a degree) has led to previously unrealized insight into student patters of attrition. Unfortunately, this information has not been consistently applied to the furtherance of intervention strategies, often going no further than identifying trends of population-specific risk of disenrollment. Research has considered pre-matriculation factors such as gender, ethnicity and educational background in the assessment at-risk, but has largely ignored them in determining the ability of an intervention strategy to factor into the promotion of retention: a compelling exclusion in light of the broad availability of student data. The problem is that current practice largely disregards intervention approaches in population-based analysis, which can misinform enrollment management practices and exclude known student risk factors in the development and evaluation of general developmental coursework.

Purpose Statement

The purpose of this correlational study was to determine if the variables gender, ethnicity and secondary school type (public or private) held predictive significance for the year-to-year retention of residential undergraduate students who completed a developmental course at a private, liberal arts university. In addition, this research aimed to assess how the predictive patterns for each population compare to observed research trends in undergraduate education after the students engage in a developmental course. Though prior research has led to the development of marginally effective, course-based retention intervention through both mentoring and study skills focused coursework, the field of student retention has traditionally disregarded the extension of predictive analytics and the examination of pre-matriculation factors in the development or assessment of such coursework. The premise of this research asserts that the consideration of population-specific learning needs in developmental coursework can provide opportunities for improved intervention, and that the assessment of each population's response to a general developmental course can be useful in evaluating its effectiveness in promoting year-to-year retention for the purpose of predicting student enrollment.

Significance of the Study

The significance of this study is found in the extension of predictive analytics from the mere identification of academically at-risk students to effective, data-based intervention strategies for the sake of promoting year-to-year retention within a residential undergraduate population. An analytical approach to student success is a popular stance in recent higher education research (Davis & Burgher, 2013; Delen, 2010); however, the use of such analysis is frequently limited to the identification of specific populations, which often leads to overgeneralization of both risk factors and categorization (Adams, 2011). Analyses that lead to

more precise at-risk identification have traditionally been used to frame the issue of non-completion rather than to solve it.

Existing literature clearly illustrates the potential of academic-based interventions such as developmental coursework, including GPA improvement and increased persistence (Almaraz, Bassett, & Sawyer, 2010; Hoops, Yu, Burridge, & Walters, 2015; Sorrentino, 2007). Despite their impact, however, coursework-based academic interventions are traditionally designed and applied broadly to whole groups to treat a single perceived deficiency, rather than to known at-risk populations. Though broad approaches have proven to increase the retention rate above that of untreated subjects (Maher & Macallister, 2013), this success can mask the inherent limitations of a broad intervention and hinder the exploration of more effective methods.

The intent of this study was to assess the potential value of extending predictive analytics from mere identification of "risk" to the treatment of notable population-specific deficiencies. Far more than establishing a best-practice microcosm for the institution, the significance of this study lies in the theoretical implications of improving the assessment of intervention strategies through the application of already strong analytic approaches. By affirming the concept of data-driven intervention through research, institutions can more effectively manage year-to-year enrollment, as well as leverage existing data to create holistic, student-centered academic intervention strategies (Kalsbeek & Hossler, 2010).

Research Questions

RQ1: Can gender predict the year-to-year retention of residential undergraduate students who complete developmental coursework at a private, liberal arts university?

RQ2: Can ethnicity predict the year-to-year retention of residential undergraduate students who complete developmental coursework at a private, liberal arts university?

RQ3: Can secondary school type predict the year-to-year retention of residential undergraduate students who complete developmental coursework at a private, liberal arts university?

Null Hypotheses

H_0**1:** Gender does not significantly predict the year-to-year retention of residential undergraduate students who complete developmental coursework at a private, liberal arts university.

H_0**2:** Ethnicity does not significantly predict the year-to-year retention of residential undergraduate students who complete developmental coursework at a private, liberal arts university.

H_0**3:** Secondary school type does not significantly predict the year-to-year retention of residential undergraduate students who complete developmental coursework at a private, liberal arts university.

Definitions

1. *Attrition* – The occurrence of a student neither graduating nor continuing to study at the same institution in the following year (Grebennikov & Shah, 2012).

2. *Persistence* – A student's ability to make progress towards personal educational goals, evidenced by their continued successful enrollment (Bahi, Higgins, & Staley, 2015).

3. *Retention* – The occurrence of a student returning to a college or university year after year until graduation (Roberts & Styron, 2010).

4. *Predictive Analytics* – A tool in post-secondary student retention practices that uses statistical analysis to predict the behavior of specific groups of students (Davis & Burgher, 2013).

5. *Title IV Financial Aid* – An inclusion in the Higher Education Act that provides financial assistance for post-secondary education in the form of loans, grants and work-study opportunities (Department of Education, 2015).

6. *At-risk* – Students that have a statistically low probability of degree completion based on their shared characteristics with previously unsuccessful students (Davis & Burgher, 2013).

7. *Mentoring Course* – A class designed to facilitate an exchange of advice, counseling and experiential exchanges between an institutional designee and a student at-risk for attrition (Sorrentino, 2007).

8. *Study skills Course* – Curriculum designed to promote the academic skills necessary to succeed at the undergraduate level, including self-management, knowledge attainment and communication skills (Pryjmachuk, Gill, Wood, Olleveant, & Keeley, 2012).

9. *Developmental Education* – Coursework designed to mitigate or remediate a perceived academic deficiency in order to promote student retention (Pruett & Absher, 2015).

10. *Secondary School Type* – A point of distinction used for this study between various student's educational experiences, whether occurring in a public or private setting.

CHAPTER TWO: LITERATURE REVIEW

Overview

Collegiate student retention is a topic of specific interest for a varied set of stakeholders, and, like most subjects with direct fiduciary implications, boasts a litany of contemporary research. Student attrition is commonly perceived as "either a failure in the selection of students or a failure to identify students and to provide interventions for students who are at-risk for attrition" (Ackerman, Kanfer, & Beier, 2013, p. 912). The resulting breadth of prevalent literature ranges from student engagement theory to applied predictive analytics, with a common aim of either diagnosing or remediating a student deficiency that may lead to institutional withdrawal. The focus of this literature review rests on the history, philosophy and pragmatic aspects of modern retention approaches, which demarcates similarly by function: improved identification of, or intervention for, students at-risk of non-completion.

In support of the study at large, this review targets literature that speaks to the insight of common identification methods and the pragmatism of direct intervention. This review also dissects the role of each predictor variable as it relates to population retention and comparative volatility. As a whole, this review affirms the necessity of the study by illuminating the incongruent application of at-risk categorization to identification strategies but not intervention approaches. Hagedorn (2005) further notes that despite the modern investment in the field of student retention data analysis, measuring student retention remains "complicated, confusing and context dependent" (p. 90). This reality validates the assertion that, despite a focused emphasis on improving student success rates nationwide, the field of student retention intervention has remained limited in terms of data-based assessment and innovation (Junco, Elavsky, & Heiberger, 2013).

Theoretical Framework

Undergraduate students are believed to fail to retain at a given institution for a variety of reasons; thus, attempts to intervene stem from a number of disaggregate theories and approaches (Kerby, 2015). As much as key theorists have contributed to the development of modern retention practice, Demetriou and Schmitz-Sciborski (2011) assert that the historical progression of American higher education and the field's philosophy have arguably been equivalent architects in its development. The following section details the chronology behind the progression of retention philosophy and its resulting theories.

Foundations of Student Retention Theory

At-risk categorization was, at the onset of formal post-secondary research, unilaterally assigned to a given population on the basis of broad membership rather than individual or population-based risk factors. Though the United States government began formally collecting student data in the 1860's with the creation of the Department of Education (Fuller, 2011), this information focused more on the institution and provided little insight into the nature of student movement. Throughout the first half of the twentieth century, it was formally held that non-completion was a student issue: one of inaptitude or institutional incongruence (Demetriou & Schmitz-Sciborski, 2011). According to Braxton and Hirschy (2005), this philosophy, paired with the commonality of attrition at the time, postponed the necessity of formal retention research until both enrollment and attrition increased in the higher education rush that followed World War II.

As the G.I. Bill facilitated exponential growth in the higher education sector, the social reforms of the civil rights movement also worked to alter post-secondary access (Demetriou & Schmitz-Sciborski, 2011). Berger, Blanco, Ram'rez, and Lyon (2012) note that these

gravitations irrevocably changed the makeup of the American college student in terms of academic preparedness and SES. In response to the changing post-secondary landscape, researchers and theorists began to rethink the problem of student retention as one to be countered rather than simply identified and explained (Kerby, 2015). This shift triggered two primary theoretical responses: organic social engagement and academic reinforcement (Berger et al., 2012). Though superficially dichotomous, these approaches stem from a shared theoretical body and aim to remediate many of the same core deficiencies. The following sections detail the theoretical premises behind the most prevalent methodologies.

Spady. The first inclusive empirical work recognized in student retention appeared in 1970 as Spady delivered a sociological model of student drop-out that accounted for both academic and social factors (Kerby, 2015). Derived from fellow sociologist Emile Durkeim's unrelated model of patient suicide, the author presented five primary factors in determining student persistence, which he noted are analogous to an individual's will to live in Durkeim's model: academic potential, normative congruence, grade performance, intellectual development and friendship support (Spady, 1971). Though Spady's model values a balance of academic and co-curricular factors, the theory was refined to espouse formal academic performance as the single greatest factor in determining student success through further research (Demetriou & Schmitz-Sciborski, 2011).

From this model, Spady (1970) advocated for institutions to reform facets of the student experience deemed specifically prohibitive to academic success. This included academic accommodations, faculty engagement and the facilitation of academic development and efficacy. Though Spady's revised model was decidedly academic in scope, it also maintained its original elements of social engagement, noting that faculty engagement served a social and academic

function. Kerby (2015) notes that although Spady's work was synchronous with other contemporary theorists, the academic formalization of a student-centered approach represented a fundamental departure from the traditional perception of assumed institutional infallibility.

    Bandura. Social learning theory (Bandura, 1977) is an atypical philosophical pillar for a field such as student retention, but it has a distinct role in much of modern academic intervention strategy; particularly academic remediation. The theory asserts that the social environment of formal learning creates an implied social construct, in which informal societal contracts can be leveraged or manipulated to foster a positive learning atmosphere (Renkl, 2014). "Fortunately, most human behavior is learned by observation through modeling. By observing others, one forms rules of behavior, and on future occasions this coded information serves as a guide for action" (Bandura, 1977, p. 47). Indirectly, Bandura's premise has contributed to a variety of modern undergraduate retention practices, including freshmen learning communities, academic cohorts and remedial education (Adams, 2011; Antonio & Tuffley, 2015; Davis & Burgher, 2013).

    It is within the greater aims of remedial education, specifically self-efficacy, that Bandura's work finds significance in the framework of retention. Defined by Bandura (1977) as "the conviction that one can successfully execute the behavior required to produce the outcome" (p. 193), efficacy has become a prevalent aim of collegiate developmental education. Its inclusion and rise is due in part to the stage malleability of student efficacy (Raelin et al., 2014), but also due to its established affect in minimizing individual student deficiencies to increase persistence (Martin, Goldwasser,, & Harris, 2015). Bandura (1977) further noted that efficacy was a primary driver of personal agency, which is critical to the maturation of students within a volatile population (Raelin et al., 2014, p. 603).

Tinto. Building upon the foundation set by Spady and other contemporaries, Tinto

(1975) conducted an in-depth literature review with conclusions that rose to become the seminal

work in student retention (Berger, Blanco Ram'rez, & Lyon, 2012). Tinto's (1975) engagement

theory postulated that the extent to which students engage in the institution and the

undergraduate experience determined their ability to succeed, and therefore, retain. Berger et al.

(2012) note that engagement in this regard referred to the substance of the institutional

experience, which they asserted determined the extent to which a student became committed to

the institution. Thus, if an institution could promote organic, naturally occuring engagement, it

could in turn slow the erosion of the student populous (Flynn, 2014).

The core of Tinto's engagement theory has remained impressively intact through four

decades of refinements (Kerby, 2015) and a nearly complete transformation of the field as a

whole (Demetriou & Schmitz-Sciborski, 2011). Despite early attempts to explain attrition

through engagement (Grebennikov & Shah, 2012), it's practical value has come as a remedy

rather than a diagnostic tool as increased engagement has shown to promote student retention

across student populations with a variety of disaggregate risk factors (Maher & Macallister,

2013). This principle is echoed in the theoretical models that followed or gained new relevance

from Tinto, including Bandura's (1977) social learning theory and Locke and Latham's (1990)

goal setting theory of motivation, which both aim to increase student success through increased

engagement (Sorrentino, 2007). Engagement theory also played a significant role in shaping the

higher educational landscape uniformly as the promotion of student engagement rapidly became

an institutional expectation (Baer & Duin, 2014).

Astin. A parallel theory to Tinto's earlier work was presented by Astin (1999) in

promoting student involvement as a panacea for attrition risk. In it, he submitted that

involvement-evidenced by initiative and dedication-are early indicators of persistent behavior, and that involvement in nearly any application correlates positively with persistence, with some variation by demographic population (Roberts & Styron, 2010). Astin (1999) defined an involved student as one who "devotes considerable energy to studying, spends much time on campus, participates actively in student organizations, and interacts frequently with faculty members and other students" (p. 518). Unique to Astin's work is the adaptation of involvement into pedagogy rather than a unique co-curricular retention initiative (Foreman & Retallick, 2013). His conclusion paralleled that of Spady in advocating for institutions to assess the extent to which their academic and social landscape facilitated overall student satisfaction (Astin, 1999).

Despite their popularity, engagement based theory lacks the diagnostic pragmatism required to guide the facets of student retention that inform intervention practice (Flynn, 2014). Engagement is, in itself, an inexact ideal; with far greater applications on an individual basis than as a holistic institutional strategy (Davidson & Wilson, 2013). The value of individual engagement initiatives is affirmed in Pike and Graunke's (2015) cohort engagement research, `O'Keeffe's (2013) social belonging study, and Fritz'(2011) social reinforcement experiments; all of which reinforce the value of promoting individual engagement within a specific population.

Furthermore, as a holistic intervention strategy, engagement theory is insufficient to account for student risk factors such as academic preparedness and familial support (Grebennikov & Shah, 2012). Smart and Paulsen (2011) note the extensive limitations of Tinto's original theory in its disregard for educational and social experience factors prior to institutional matriculation; a limitation reinforced by Grebennikov and Shaw (2012), Davis and Burgher

(2013) and Freitas et al. (2015). Engagement theory has proven effective as a means of mitigating the impact of risk factors among undergraduate students, but it is an ineffective solution for the identification and circumvention of such factors as a stand-alone intervention strategy (Smart & Paulsen, 2011). For this reason, it is important for institutions to move beyond broad engagement strategies and into informed intervention that leverages the strengths of retention theory and the insight of existing student data to identify effective models for promoting student success.

Supporting Theories

An industry-wide preoccupation with Tinto's original work is representative of the breadth of retention literature, however numerous other theorists contributed significantly to the development of modern retention theory and practice. Though Tinto's (1975) theory is regarded as a seminal work in the field of student retention (Demetriou & Schmitz-Sciborski, 2011), the theorists that follow play a decidedly more significant role in the formulation of the theoretical construct used for this study. The following section details the contributions of key theorists as they relate to academic and para-educational intervention.

Goal-setting Theory. The concept of using goal-based motivation as a means of pulling individuals towards desirable outcomes was formalized by Locke in his 1964 doctoral dissertation, and later popularized in a related study (Locke & Latham, 1990). At its core, the theory proposes that goal-setting serves as a vehicle to provide knowledge of performance, ideal standards and tangible progress (Moeller, Theiler, & Wu, 2012). Supported by empirical research and numerous replication studies, goal-setting theory has gained popularity as a valid means of behavior modification and motivation enhancement among individuals in an academic setting (Sorrentino, 2007). This theory has found numerous applications within academics,

including engagement initiatives (Antonio & Tuffley, 2015), academic development (Moeller et al., 2012) and academic mentoring (Sorrentino, 2007). Similar to most intervention strategies, goal-setting theory is considered a valid approach for promoting student persistence at the undergraduate level (Moeller et al., 2012).

Bean's Attrition Model. The majority of the theoretical output from the 1970's focused on the subvert, inorganic treatment of attrition risk within a student population as a whole (Kerby, 2015); however, Bean (1980) presented a model for understanding student risk through the lens of prior experiences. This construct coupled retention staples such as engagement and the student experience with student-centric considerations such as academic experience factors, geography, SES status and college preparedness (Demetriou & Schmitz-Sciborski, 2011). In doing so, Bean provided the first widely-accepted diagnostic theory for student risk, and laid a foundation upon which the modern data-driven predictive analytics have thrived. In demonstration of this theory, Kanika (2015) notes the range of college preparedness observed for students of varying educational backgrounds. Similarly, Kirby and Sharpe (2011) illustrate this factor in noting the unique transitional needs created by a student's secondary school environment; a factor of interest in this study.

Theoretical Research Construct

The above theories are individually sufficient for approaching the problem of retention. Numerous studies have been conducted to test the validity and effectiveness of each as they relate to undergraduate student success, and each has made notable strides in promoting degree completion. The aggregation of these factors, however, is far less prevalent, and this vacuum has created the necessity for further research aimed at assessing the effectiveness of hybrid approaches.

This study aims to explore the effectiveness of a theoretical construct that leverages the insight and specificity of Bean's model with the intervention strategies prescribed by Bandura (1986) to replicate the effect of holistic student engagement espoused by Tinto. Specifically, this study will measure the effectiveness of two disparate social learning-based intervention courses on the basis of each student's unique make-up within the scope of this research. Through the individual success of each approach, the literature supports the belief that inroads to improved retention may be found through the consideration of student experience factors in the facilitation of developmental coursework.

Related Literature

The focus of modern retention literature is focused primarily on two applications of the field's core theories: identification of at-risk students and intervention on their behalf. Though these approaches are not mutually exclusive and do share several studies, categorization by approach allows for a synchronous review of information that will serve to illuminate the perceived research gap upon which this study is built.

Target Student Variables

The three predictor variables represented in this study, gender, ethnicity and secondary school type, mirror common "at-risk" populations and are particularly valuable for examining the variable effectiveness of developmental coursework. These characteristics were included on the basis of their variability, researched volatility and broad representation in current research. Each characteristic is present in all research subjects in varying forms, thus increasing the potential external population validity of the study (Gall, Gall, & Borg, 2007). The following sections detail each population characteristics' relevance to this study and the field of retention as a whole.

Gender. Gender is a common variable in retention-based research, due in part to its consistent disparity in national and international higher education (Barrow, Reilly, & Woodfield, 2009; National Center for Education Statistics, 2016), as well as its broad availability as a data-point and inherent lack of multicollinearity. In the United States, five-year degree completion for males outpaced that of females consistently from 1965 until 1988, often by as much as nine percentage points (Alsalam & Rogers, 1990). Since 1989 however, female degree completion has been dominant in comparison to males (National Center for Education Statistics, 2016; Wirt et al., 2004). More recently, from 2008 to 2014, the aggregate six-year graduation rate for females was five percentage points higher than that for males: a gap that extended to eight percentage points when examining private university student data such as the host institution in this study.

A number of theorists have attempted to explain this shifting incongruence across different phases of higher education thought. In the 1980's, the disparity of outcomes by gender was asserted to be a partial function of examiner bias in favor of males (Pazy, 1986; Sidanius & Crane, 1989; Swim et al., 1989) and a poor psycho-social environment for females (Barrow, Reilly, & Woodfield, 2009): the latter gaining momentum from Spady's (1971) sociological model pitting institutional fit against individual aptitude. Other contemporary studies aimed to explain more favorable outcomes for males as a result of cognitive ability (Rudd, 1988; Goodhart, 1988); an assertion that is repeatedly challenged by McCrum (1994, 1996) who notes instead the social and institutional factors involved in degree selection and performance at traditionally elite institutions.

The degree completion gap closed and eventually widened in favor if females in the 1990's, and the focus of research shifted from degree attainment to the quality of the degrees

earned, where it remains (Woodfield & Earl-Novell, 2006). Male dominance in UK first class degree programs and disproportionately low female participation and retention in STEM-based degree programs in the US and abroad have been looming concerns and popular research fields over the past 20 years (Baskin, 2012; Woodfield & Earl-Novell, 2006). The selection/aversion differential between genders has also been attributed to innate intelligence or cognitive aptitude (Coe et al., 2008; House of Lords, 2012; Smith, 2010), as cited in Smith & White, 2015). Ackerman, Kanfur, and Beier (2013) attribute the difference largely to pre-matriculation factors such as advanced high school preparation and individual disposition rather than intelligence. Citing participation in Advanced Placement coursework and self-assessed anxiety traits, the authors point to a need to significantly alter secondary-level preparation and participation in STEM focused content areas in order to bring about a change in the retention and completion of female students in undergraduate STEM programs.

Gender has been a consistent theme in retention-based research and a staple risk factor in standard analysis (Astin, 1975; Peltier, Laden, & Matranga, 2000; Reason, 2009); however, the nature of its inclusion may be less directly attributable to group membership than to situational student patterns. A recent multinomial regression analysis conducted by Campbell and Mislevy (2013) focused on the interaction effects of common at-risk factors such as preparedness, confidence, gender and ethnicity, and indicated several differences in retention patterns by gender. For males, retention patterns showed a direct relationship with reported academic preparation and study skill efficacy. This coincides with prior research indicating the positive role of institutional investments in confidence and academic preparation for student persistence, especially for at-risk populations (Archibeque & Gloeckner, 2016; Cabrera et al, 1993; Engle & Tinto, 2008). For females in the study, participants were shown to be at higher statistical risk of

attrition if they were unclear on their degree or career goals. This finding is supported by prior research findings which note the psycho-social factors involved in post-secondary education enrollment decisions for female students (Ackerman, Kanfur, & Beier, 2013; Smith & White, 2015).

Engle and Tinto (2008) note that effective developmental education, when used as an intervention strategy, must meet the specific learning needs of the participants. "The closer the alignment, the more likely students will be able to translate the support into successful classroom performance" (p. 25). Similarly, Ackerman, Kanfer and Beier (2013) state that student attrition is often attributable to an institutional failure at proper selection, identification or intervention for at-risk populations. Ruling out selection and identification by gender as institutional failures, gender considerations in intervention and assessment provide opportunities for improvement in the outcomes of developmental education, and remain under-researched in current retention literature.

Ethnicity. Outside of charted academic deficiencies, the risk category of ethnicity represents one of the most popular research topics in the area of undergraduate student retention (Knaggs, Sondergeld, & Schardy, 2015; Peltier et al., 2000). Unlike the category of gender, ethnicity maintains several unique complications as the implied disadvantages are not attributable to innate population membership, but rather to historical group performance and/or commonly related risk factors such as low SES, first-generation college student status or insufficient K-12 preparatory education (Knaggs et al., 2015; Reason, 2009; Talbert, 2012). This reality creates a uniquely challenging retention environment as intervention specialists must operate without a membership-specific prescription or a distinctly remediable deficiency. Ethnicity has consistently proven to be a chartable risk factor for predictive student

identification, but is a comparably complex factor for intervention (Reason, 2009; Rigali-Oiler & Kurpius, 2013).

The persistence and graduation of students from underrepresented minority groups has been a popular but developing research focus for the last 40 years (Rigali-Oiler & Kurpius, 2013), and a specific target of the Federal government throughout the Obama administration (Talbert, 2012). Rose (2015) notes that the United States' vested interest in higher educational attainment must rely heavily on the retention and eventual degree completion of underrepresented minority students due to their sizeable representation in American Higher Education and the nation as a whole; a sentiment echoed by the Obama administration (Talbert, 2012). For undergraduate completion to truly be a societal success, it must include all participants.

Despite this attention, gains have been minimal and, true to form, lopsided across various ethnicities (Camera, 2015; Payne, Slate, & Barnes, 2013). According to a 2015 study of Integrated Postsecondary Education Data System (IPEDS) data by The Education Trust, the retention of underrepresented minority groups increased moderately from 2003 to 2013 nationally, but remains noticeably incongruent with that of Caucasian students (Camera, 2015; Musu-Gillette et al., 2016). This inequity is even further exposed when comparing Caucasian and African American student outcomes, where Caucasian students earn bachelor's degrees at nearly double the rate of African American students despite similar educational opportunities (Cook, 2015).

This stark disparity is considered attributable to a number of historically slanted demographic factors among underrepresented minority groups. Among the more prominent in research are socioeconomic status, subpar K-12 schooling, minimal home literacy activities,

first-generation college status, unclear goals and expectations and incarceration (Cook, 2015;

O'Donnell et al., 2015; Knaggs et al., 2015; Payne, Slate, & Barnes, 2013). Of note, African

American students who graduated from private secondary schools have shown considerably

stronger undergraduate retention than their public school counterparts (Rose, 2013): a finding

that speaks to the manifold nature of ethnicity as a research variable. Because of the broad and

comparatively ambiguous nature of these potential risk factors, direct intervention efforts have

been present, but slow to develop (Cook, 2015).

Several targeted co-curricular programs involving peer mentoring and developmental

coursework have shown promise for improving the aggregate retention of this group. Knaggs,

Sondergeld, and Schardy's (2015) explanatory mixed methods analysis noted considerable

improvements, as much as ten percentage points, in post-secondary persistence for students with

low SES when participating in a pre-matriculation program focused on college readiness.

O'Donnell et al. (2015) report a direct, positive correlation between Latino students who

participate in elective co-curricular programs focused on service learning, peer-mentoring and

undergraduate research activities and year-to-year retention and degree completion. Lastly,

Camera (2015) notes that the limited number of public institutions that are realizing gains in the

retention of underrepresented minority students are innovating in the areas of peer mentoring and

population-focused developmental coursework.

Despite these promising gains, sustainable population headway has been sluggish, even

by the industry's historically stable standards (Payne, Slate, & Barnes, 2013). Changing

workforce needs and the evolving national demographic makeup further necessitates

improvement in the success of underrepresented minority students at the undergraduate level

(O'Donnell et al., 2015). The continued designation and perception of ethnicity as a risk factor

holds significant implications for both institutions and students, and remains a critical research topic (Musu-Gillette et al., 2016; O'Donnell et al., 2015).

Secondary School Type. An examination of current literature yields consistent data on the academic success of students according to secondary school type. Frenette and Chan's (2015) cross-sectional study on educational outcomes across more than 29,000 participants revealed considerable leads in both overall academic performance (as measured by standardized tests) and total degree attainment for students attending private schools versus those attending public schools. Similarly, Altonji, Elder and Tabor's (2005) study on private Catholic school student performance shows a marked advantage for private school attendees in terms of secondary school completion and college attendance, extending even to students hailing from urban city centers.

Despite the broad disparity in the outcomes of each school type, the differences have been proposed to equate more directly to the demographic makeup of the students rather than the quality or preparatory ability of the schools themselves (Altonji et al., 2005). Specifically, private school attendees traditionally hold notable advantages in in socioeconomic status and familial educational attainment (Frenette & Chan, 2015); two characteristics that have correlated positively with academic achievement on a consistent basis (Camera, 2015; Rigali-Oiler & Kurpius, 2013). Illustrating this assertion, the National Center for Education Statistics' contested 2003 report showing comparable standardized test performance for public and private school attendees shows the inverse when removing controls for demographic characteristics (Peterson & Llaudet, 2007). "The study's adjustment for student characteristics suffered from two sorts of problems: a) inconsistent classification of student characteristics across sectors, and b) inclusion of student characteristics open to school influence" (p. 75). This finding illustrates the student-

based, rather than institution-based, nature of differences in secondary school outcomes by school type.

Rose (2013) further highlights the impact of school context and educational opportunities on collegiate retention, specifically for traditionally at-risk student populations. A logistic regression analysis of academically high-achieving African American males revealed decreased probability of bachelor's degree attainment for urban school graduates, and increased probability for African American students graduating from a private school. The author's findings are consistent with national academic achievement trends for urban school attendees and students with low socioeconomic status (Camera, 2015), but also serves to qualify ethnicity as an indirect risk factor (Rose, 2013). This research affirms the danger of assigning risk on the basis of a single factor as socioeconomic status has established ties to several traditional risk factors, and often confounds empirical risk assignment (Camera, 2015; Rigali-Oiler & Kurpius, 2013; Rose, 2013).

Subtle differences in faculty and staff efficacy and school settings have also arisen from research in addition to those noted in public and private secondary school attendees. Breen (2015) cites a recent qualitative study in which 10% of public school principals attributed poor student performance to low expectations of teachers, compared to just .05% reported by private school principals. This concept is supported in research, and is not limited to the expectations of private school teachers (Kraft, Marinell, & Yee, 2016). Similarly, Wilson points to expectations of parents as a major driver of faculty performance, noting that private school parents typically expect a return on their financial investment (as cited in Breen, 2015). In addition, private schools typically maintain smaller enrollment, which provides the opportunity for individualized attention from college and career counselors who can provide information and support for

college preparation (Park & Becks, 2015). Conversely, public high schools typically offer a broader range of academic opportunities such as Advanced Placement (AP) and college preparatory coursework, which has correlated positively with both initial college attendance and year-to-year retention (Parks & Becks, 2015).

Other differences in public and private settings relate to the profile of the educators themselves. Goldring, Gray, Bitterman, and Broughman (2013) note that private school teachers, on average, are less diverse (88% Caucasian compared to 82% for public school teachers), hold fewer advanced degrees (36% with earned Master's degrees compared to 48% in public schools) and earn less ($40,200 annually compared to $53,100) than their public school counterparts (p. 3). These differences, though subtle, hold downline implications for students as a lack of faculty diversity has been shown to contribute to a negative learning environment for minority students (Ahmad & Boser, 2014).

Current literature shows chartable differences in outcomes for students on the basis of secondary school type, with an emphasis on student characteristics over institutional factors, and resource limitations over method deficiencies. In relation to this study, prior research focuses on college preparation and lifetime academic achievement by secondary school type, but does not investigate a response to academic intervention, leaving a sizeable gap for such research. Studies such as the Wenglinsky Report for the Center on Education Policy (2007) reveal a considerable advantage for private school graduates in terms of aggregate lifetime academic achievement, but do not analyze each cohort's response to academic-based intervention while engaged in undergraduate studies. If intervention approaches are to consider secondary school type as a factor for student success, research must be conducted on the population's response to available intervention.

Data-Driven Enrollment Management

Enrollment Management models are gaining popularity in modern higher education as a means of projecting revenue and properly allocating institutional resources through the data-based recruitment and retention of students (Langston, Wyant, & Scheid, 2016). "Both an art and a science, enrollment projections have become a major component to effective college and university fiscal planning" (p. 74). This form of institutional management has become necessary due to increased national competition and demands for higher levels of accountability in post-secondary education as an industry (Dennis, 2012).

Langston et al., (2016) advocate for the use of historical applicant conversion trends and population-specific persistence tendencies to predict both new student enrollment and potential student attrition. Dennis (2012) further notes that effective enrollment management must be anticipatory in nature. "…to anticipate trends that may affect future enrollment, you have to be curious, always looking for new information and data and then using that information to affect institutional enrollment and retention practices" (p. 14). Within this premise, the purpose of this study gains significance as the enhanced prediction of student enrollment trends yield direct benefits to the health of an institution.

At-risk Identification

The majority of identification-based retention literature is largely focused on the concepts of at-risk identification and timely action (Delen, 2010). This vein of research uses student data, such as age, gender, race, ethnicity, academic history, SES, geography and family history to categorize or further predict a student's likely enrollment history (Freitas et al., 2015). This method leverages institutional data to make meaningful correlations between past unsuccessful students and current students who may be in need of intervention (Baer & Duin, 2014). This

practice has proven to be a reliable means of obtaining a sound prediction due to the fact that the road availability of data and consistent nature of risk factors across time has made for a reasonably stable algorithmic environment (Boston, Ice, & Burgess, 2012; Soria, Fransen, & Nackerud, 2014).

Applications of at-risk analysis vary by institution, often based on specific needs or resources. For some, predictive analytics represent a potent instrument for aligning student services with demand (Soria, Fransen, & Nackerud, 2014) and ensuring that adequate academic support is available. Webster and Showers (2011) outline this application by noting the use of retention data to assess existing student success initiatives and the impact of mandatory developmental coursework. In this vein, at-risk analysis is also viewed as a means of stabilizing enrollment (Kalsbeek & Hossler, 2010): whether through improving student services (Kerby, 2015), creating dynamic learning experiences, or by bolstering existing student success initiatives (Freitas et al., 2015). These applications do not fall beyond the scope of standard institutional data use, but can provide powerful insight when viewed through the lens of student success and retention.

For others, this data provides an opportunity to rethink their recruitment strategy in order to reduce non-completion in future terms. Angelopulo (2013) notes predictive analytics' use in modern enrollment management as an effective means of forecasting student movement and casting effective strategies for both recruitment and retention. In a similar study, Grebennikov and Shah (2012) illustrate this preventative application in advocating for a qualitative approach to predictive modeling for the purpose of avoiding students that are unlikely to retain. The authors submit that through careful observation of attrition trends and extensive qualitative input, institutions can gain insights for broad improvements to the student experience as a whole as

opposed to a targeted issue, which will in turn promote engagement and increase student retention. This approach does not incorporate the advanced statistics and predictive analytics common to modern retention models, however its qualitative insights illustrate a common sentiment among retention practitioners and theorists that advanced knowledge of who is likely to withdrawal provides increased opportunities for effective retention intervention (Raisman, 2011).

Other models rely exclusively on predictive analytics, and have proven valuable in facilitating timely administrative action (Davis & Burgher, 2013). These methods utilize historical algorithms to detect trends in student attrition and persistence in order to "predict" what student demographics may lead to eventual non-completion (Sarkar, Midi, & Rana, 2011). Despite the considerable attention this approach has gained of late, this method is fundamentally limited to correlating statistical similarities between past and current students. As such, it depends exclusively on demographic assumptions that often lack significant qualitative support (Raisman, 2011).

Still, there can be tremendous value in statistical insight, specifically for institutional planning. Boston, Ice and Burgess (2012) examined enrollment behavior at a large online institution focused on adult education, for the sake of resource allocation and strategic management rather than direct intervention. This approach, which prioritizes systemic improvements over categorical intervention, mitigates the risk of false prediction by using data to improve the student experience as a whole, thus leveraging engagement theory to improve institutional loyalty organically (Raisman, 2011).

Though broadly applicable and comparably low-cost, the generic nature of this approach risks ineffectiveness. Nix, Lion, Michalak, and Christensen (2015) strongly advocate for

individualization in retention initiatives, pointing to the egocentric nature of the current college-bound generation and the advantages of informed intervention. Focused on GED holders, the authors' research shows a positive response to mentoring-based intervention; a major focus of this study as a whole. Despite the empirical success of mentoring programs, such an approach requires considerable resources. The reality of modern higher education is such that budgetary constraints often trump sound practice, to the detriment of the student (Kalsbeek & Hossler, 2010). In response to this conflict of resources, Raisman (2011) notes that that student attrition and acquisition costs are typically far greater than basic investments in student retention, even for institutions with a reasonably healthy retention rate.

A notable exclusion in current practice is the direct involvement of the student in the acknowledgement of risk. A comparably small measure of modern literature does advocate for the involvement of students in the retention process; however, involvement in these limited applications is focused on the most basic of student risk factors, such as continual academic failure. Dumbrigue, Moxley and Najor-Durack (2013) assert that students must be involved directly in the "process and outcome of retention" (p. 4), but stop well short of making specific recommendations or suggesting that this information should be used in attempts to remediate the potential deficiency. The authors do stress however the importance of helping students self-diagnose, and of supporting them through the resulting decision process (Dumbrigue et al., 2013). Though it contains several contrarian viewpoints, the study of Dubbrigue et al. (2013) is ultimately representative of the larger body of literature as it does not propose a specific intervention beyond the general prescription of modernized elements of Tinto's engagement theory.

At-risk Intervention

The other major companion research thread in undergraduate retention examines the intervention strategies themselves. These approaches aim to intervene by providing support, care or mentoring where needed, as often dictated by institutional data (Baer & Duin, 2014). The majority of intervention attempts appear in in one of two forms: a narrowly focused approach, which is typically generated from within a specific academic or co-curricular department, or a broad, generic strategy stemming from an institutional focus on enrollment (Kalsbeek & Hossler, 2010). The former relies on a narrowly focused strategy aimed to remedy a specific deficiency within a specific population. The latter, in sharp contrast to both this approach and identification efforts, uses a generic, broadly applicable approach directed to the broader macrocosm of a whole institution, aiming to positively impact the overall student experience for a large number of students regardless of their individual risk factors or pre-matriculation profiles (O'Keeffe 2013).

Both approaches are grounded in a clear theoretical framework, and can be more clearly delineated by such. Broad intervention strategies reflect a desire to protect students from the challenges of the institutional system: a focus of early retention research in the United States (Berger, Blanco Ram'rez, & Lyon, 2012). This concept was a core element of both McNeely's (1937) findings as well as in Kamen's (1971) assertion that natural incongruence exists between post-secondary education and developing students. Such approaches aim to mitigate this natural conflict by fostering an overall campus atmosphere that is engaging and supportive (Tinto, 1975).

Conversely, narrowly focused intervention strategies aim to protect students from themselves when they would otherwise choose to remain at an institution. Just as many students are considered at-risk for their lack of engagement, other students are at-risk for their inability to

make satisfactory academic progress or to adhere to required social or behavioral expectations. The focus of such strategies is typically on either a specific student population or a specific deficiency.

A small percent of studies do take a more narrow approach in testing various models to promote the success of specific populations (Meling, Mundy, Kupczynski, & Green, 2013). This approach is typically more resource-needy and has a more narrow impact than the generic strategies discussed above; however, they theoretically hold the potential to bring about a more profound or more specific change among those exposed (Almaraz, Bassett, & Sawyerr, 2010). This type of approach has typically stemmed from a known problem area with poor success rates such as STEM programs, online education, Law school or Nursing programs, where a student's individual risk factors are thought to be somewhat less prohibitive than the challenge of the program itself (Castro, 2014; Fontaine, 2014; Inouye, Ouyang, Couch, & Yeager, 2015; Windsor et al., 2015).

Developmental coursework

The intervention strategy of interest in this study is developmental coursework, which is typically either mandated by the university as a means of academic discipline or offered as an elective. This approach typically categorizes students broadly as academically at-risk, and aligns resources based on common academic deficiencies. Though these courses vary greatly by institution and desired learning outcomes, two common approaches are study skills and mentoring. The following section details the application of both strategies as they represent a specific area of interest to this study.

Study skills. Courses designed to increase student's academic capabilities are common, especially among large universities with diverse enrollment. These courses generally focus on

skills such as time management, note taking and study preparation (Hoops, Yu, Burridge, & Wolters, 2015). Transparently, these courses are designed to combat academic deficiencies common to transitioning undergraduates in order to promote increased academic success (Conway, 2011). These courses have proven effective in multiple studies (Hoops et al., 2015; Pryjmachuk et al., 2014), and are generally regarded as a function of an institution's social responsibility to ensure a return on each student's investment in higher education (Vasquez, Lanero, & Aza, 2015).

Despite the general success of study skills courses, they are inherently generic in nature, and commonly operate from the premise that all academic shortcomings are the result of insufficient preparedness (Raisman, 2011). Though this proverbial shotgun approach is likely adequate for resolving the root issue of poor academic preparation, it can, without a degree of intentionality, lack the strategies needed to treat specific preparatory deficiencies, and the flexibility to provide alternative remedies that suit said deficiencies (Wernersbach, Crowley, Bates, & Rosenthal, 2014). Further, only limited research has been conducted to evaluate the effectiveness of such courses on disparate student groups. Within this limitation, the purpose of this study gains relevance as it attempts to assess the effectiveness of study skills courses for promoting retention among students with a variety of formal and informal educational experiences.

Mentoring. Complementary to study skills courses, mentoring programs are used by numerous universities to promote engagement and support the development of at-risk students (Latham, Ringl, & Hogan, 2011; Sorrentino, 2007). Mentoring is most commonly seen as a para-educational practice, often conducted by peers or faculty mentors (Collings, Swanson, & Watkins, 2014). Though the practice has gained popularity in the last 20 years, mentoring

studies have shown consistently positive results as a means of promoting engagement and student retention (Collings, Swanson, & Watkins, 2014; Khazanov, 2011; Latham, Ringl, & Hogan, 2011).

Mentoring is typically either an elective or an informal practice; however, some institutions have found success in formalizing the activity. Gershenfeld (2014) examined twenty unrelated formal mentoring programs, and noted significantly different approaches with similarly strong results in terms of student engagement. With a proven record of effectiveness, it stands to reason that mentoring is an effective practice that should be promoted across all college campuses. Still, little is known regarding the particular deficiency that mentoring addresses. Though the practice has undoubtedly promoted retention through engagement (Sorrentino, 2007), Gershenfeld's (2014) study showed that research is insufficient to answer whether it holds more value with certain student populations. This gap lends credibility to the primary study as a firm correlation between mentoring and student success is indeterminable beyond basic engagement theory principles.

Rising Alternative Applications

From the point at which Tinto's (1975) engagement theory gained momentum in the 1980's, published retention initiatives and research have consistently reflected a desire to retain students through increased engagement; both student to student and student to faculty (Berger et al., 2012). A less empirical but somewhat more holistic approach however involves the promotion of engagement between the student and the institution. Though this relationship would seem illogical due to the relational limitations of the university, this alternative approach has proven effective in increasing student satisfaction and, by default, student persistence (Schreiner & Nelson, 2013).

Satisfaction-based intervention ("rising tides"). An intentionally unspecific method of intervention aims to improve the overall student experience in a broad manner, with the hope that increased student satisfaction will make up for deficiencies in identification or targeted intervention approaches (Maher & Macallister, 2013). These retention-based initiatives are characteristically minor in scale, and can range from simple outreach and instructional improvement to facility renovation, increased student membership benefits, tuition stabilization, and investments in student service and support entities (Schreiner & Nelson, 2013). This approach risks ineffectiveness through its strategic ambiguity and complete dearth of direct correlative ability, but is a strong tertiary initiative for larger institutions or primary approach for those that lack sufficient resources for proper identification and intervention programs (Raisman, 2011).

Though a methodology that is, by definition, unfocused would seem both theoretically and statistically baseless, the correlation between general student satisfaction and retention is well documented. Chib (2014) highlights the importance of a student satisfaction focus among educators, noting that recognition of this principle dates as far back as Indian philosopher Chanakya in 300 B.C. Similarly, Tinto (1975) and Astin (1977) both prescribed student involvement as a means of increasing overall satisfaction, which comprised the crux of their respective theories. More recently, Schreiner and Nelson (2013), Maher and Macallster (2013) and Raisman (2011) have advocated for a student satisfaction-based approach to student retention, asserting that satisfaction and persistence show a strong positive correlation in undergraduate settings. This activity can, however, confound research findings for participating institutions.

Alternative risk theories. As a theoretical reversion to John McNeely's work for the Department of the Interior (Berger et al., 2012), a sect of modern research suggests that the institution bears responsibility for "fitting" or serving the student rather than the inverse (Chib, 2014; Kitana, A., 2016; Vasquez, Lanero, & Aza, 2015). In support of strategies aimed at improving the student experience, Raisman (2011) asserts that institution's perception of at-risk must be reframed the modern era in order to be properly understood. Citing ease of transferability, improved modes of communication, increased societal individuality and the exculpation of college transfer, the author states that risk should no longer be reserved exclusively for students with statistical disadvantages such as low SES, poor grades or a lack of familial exposure to higher education, but rather that all students are at-risk by virtue of their membership in modern post-secondary education. Simply stated, if every student is at-risk for departure regardless of their individual attributes, identifying student risk should be deprioritized in favor of identifying institutional factors that lead to, or prevent attrition on a term by term basis (Raisman, 2011).

The premise of this contrarian viewpoint requires a shift in both perspective and strategy. If all students are considered to be at-risk, the practices of identification and intervention must be appropriately subcategorized and refocused to address those who may desire to return, but are limited due to their academic performance, financial limitations or behavioral issues. The primary retention strategy would then focus on improving the student experience as a whole, and eliminating negative experiences that lead to student attrition (Raisman, 2011). This viewpoint is synchronous with broad student satisfaction strategies, with the added fundamental distinction of intentionality. This approach is not recommended as a fallback initiative or on the basis of

resource limitations, but rather as a more mission-centric method of facilitating student completion and success.

***Non-Academic Intervention**.* Raisman's (2011) work is predicated on the concept of "Academic Customer Service," a notion aimed at reforming the culture of an institution to focus on the student experience (p. 15). This model is congruent with Tinto's (1975) work, and is supported in parallel research (Maguire, 2011). Sembiring's (2015) mixed methods analysis of customer service-based enrollment trends showed a strong positive correlation between favorable customer service experiences and perceptions and student persistence. Specifically, the study showed that satisfaction in five primary areas (academic credibility, institutional stability, tangible university assets, empathetic service and communicative responsiveness) yielded higher rates of undergraduate student persistence, academic performance, relational loyalty and future career advancement.

This design closely mirrors customer retention principles found in corporate settings and in for-profit institutions (Kilburn, Kilburn, & Cates, 2014). In models more compatible with a customer-provider paradigm, such as online education, satisfaction is considered a requirement for retention, and is often featured as the institution's primary initiative for continuous enrollment (Sembiring, 2015). Still, a criticism of this approach is the risk of relationship-based cognitive dissonance within higher education if the product of instruction becomes unclear (Raisman, 2011). If the product or service being purchased is an accredited degree rather than an education, the relationship between student and teacher risks becoming contractual rather than client-based.

This criticism aside, student satisfaction-based models have shown strong results in terms of promoting student success, and also serve to add institutional responsibility to the student

retention dynamic (Kitana, 2016). Though most models account for both pre-matriculation risk factors such as age, SES, exposure to post-secondary education, prior academic performance (Demetriou & Schmitz-Sciborski, 2011) and post-matriculation factors such as co-curricular participation and academic performance (Astin, 1977), institutional service levels and palatability are often excluded. As a result, student attrition is often viewed as student weakness or incongruence (Berger et al., 2012), and holistic improvements to the student experience are overlooked as a result (Sembiring, 2015).

The significance of year-to-year retention. Perhaps a greater implication of a broader risk definition is the elevation of the aggregate volatility of the population. Such a shift accentuates specific points at which students exit the institution, and serves to elevate the importance of shorter term retention (Raisman, 2011). Term to term retention is a challenge for most institutions as both identification and intervention methods are mitigated by the short duration of student enrollment (Kassak, Kopman, & Bielikova, 2016). Research by Whalen, Saunders, and Shelley (2010) suggests that significant predictive factors for year-to-year retention are obscured by the limitations of early departure. Within this limitation, intervention methods gain significance through term to term retention not for their function as a long term educational panacea, but rather as an effective means of preventing immediate institutional disenrollment.

Summary

The field of student retention is one of sound theoretical foundations (Berger et al., 2012), abundant data (Boston, Ice, & Burgess, 2012; Delen, 2010), precise analytics (Baer & Duin, 2014; Davis & Burgher, 2013) and imprecise intervention techniques (Raisman, 2011). Numerous studies exist that measure the accuracy of predictive analytics and at-risk

identification (Freitas et al., 2015; Sarkar, Midi, & Rana, 2011), as well as the effectiveness of timely intervention on the basis of retention theory (Hoops et al., 2015; Pryjmachuk et al., 2014). Research indicates that identification strategies are becoming both increasingly granular and accurate, while intervention strategies remain grounded in general outcomes (Nix, Lion, Michalak, & Christensen, 2015; Raisman, 2011).

Still, the field remains largely subdivided by these approaches, and has not progressed to the point of testing informed intervention techniques. It is in this reality that the true research deficiency and purpose for this study emerge. Though much is known about student's statistical at-risk factors, intervention strategies as a whole have historically functioned autonomously from that data. The literature affirms the influence of budgetary concerns in this limitation (Kalsbeek & Hossler, 2010); however, Raisman's (2011) cost of attrition attests to the financial benefits of retention increases.

The concept of student volatility or at-risk categorization carries a fluid definition, and is a comparatively subjective measure. Any theorists assert that a student's volatility depends largely upon their level of involvement and the quality of their interactions. Tinto (1975) and Astin (1977) classify disengaged students as the most at-risk, whereas Raisman (2011) and Sembiring (2015) reserve that distinction for students who have been insulted by the university. Conversely, Bean (1980) submits that pre-matriculation factors are far more influential, citing past educational experiences and demographic factors. Though modern at-risk identification systems account for both theoretical constructs (Boston, Ice, & Burgess, 2012; Soria, Fransen, & Nackerud, 2014), intervention strategies are often assigned to populations deemed to be the most volatile. For the scope of this research, the more inclusive definition of volatility will be used to frame the importance placed on post-treatment retention.

Academic interventions such as remedial coursework are prescribed to students as intervention for poor academic performance; however, the coursework itself is not commonly designed to remediate a specific deficiency, but rather on the premise that the student's performance is, for one reason or another, deficient. Operating in this fashion discards the insight of identification for the sake of a more broadly applicable intervention (Smart & Paulsen, 2011). Though this strategy has clear operational merit as it requires fewer resources and eliminates the risk of faulty at-risk identification practices, it is functionally limited as all students are treated identically regardless of their risk categories. This theme is echoed throughout this literature review as the field at large lacks sufficient research in the value and effectiveness of informed, population-based intervention.

Intervention in the form of mentoring has proven effective for promoting improved academic performance and institutional retention (Sorrentino, 2007) just as study skills coursework has repeatedly tested as a valid means of raising the academic performance of undergraduate students (Seirup & Rose, 2011). Still, a noticeable research gap exists in the exploration of population-based responses to intervention. This noticeable exclusion in the combination of two major veins of retention practice (identification and intervention) represents a noticeable exclusion in light of the availability of data; however, in it lies the opportunity for increasing the effectiveness of developmental coursework to promote retention. The value of this study in the scope of retention practice is to measure the potential predictive significance of traditional undergraduate risk factors on year-to-year retention after the students have completed a developmental course. In addition, the study gains value in the assessment of each population's response to intervention. By researching the comparative impact of intervention that is designed

and evaluated on the basis of known risk factors, the concept of data-based intervention can be

marginally advanced.

CHAPTER THREE: METHODS

Overview

The following sections outline the specific statistical methods employed in the planning and execution of this research. Additional details are provided in regard to the participants, instrumentation, procedures and analysis. Attention is given to the appropriateness of the overall design, as well as the population and sample size for a logistic regression analysis.

Design

The study used a correlational research design to explore whether a significant predictive relationship exists between the predictor variables, gender, ethnicity and secondary school type, and the criterion variable, subsequent academic year retention, for undergraduate students who completed a developmental course. A logistic regression was conducted to examine the predictive relationships between the criterion variable and each predictor variable. Correlational research was chosen as the focus is on relationships between variables and not interactions (Warner, 2013). Also, a correlational design was appropriate because no variables were manipulated, but a sizeable group of participants were examined in a single study (Gall, Gall, & Borg, 2007). This approach was considered appropriate for the exploration of the research questions in accordance with the prescribed research texts, and is aligned with the methods employed in comparable retention-based research studies (Flynn, 2012; Soria, Fransen, & Nackerud, 2014).

Research Questions

RQ1: Can gender predict the year-to-year retention of residential undergraduate students who complete developmental coursework at a private, liberal arts university?

RQ2: Can ethnicity predict the year-to-year retention of residential undergraduate

students who complete developmental coursework at a private, liberal arts university?

RQ3: Can secondary school type predict the year-to-year retention of residential undergraduate students who complete developmental coursework at a private, liberal arts university?

Null Hypotheses

$H_0$1: Gender does not significantly predict the year-to-year retention of residential undergraduate students who complete developmental coursework at a private, liberal arts university.

$H_0$2: Ethnicity does not significantly predict the year-to-year retention of residential undergraduate students who complete developmental coursework at a private, liberal arts university.

$H_0$3: Secondary school type does not significantly predict the year-to-year retention of residential undergraduate students who complete developmental coursework at a private, liberal arts university.

Participants and Setting

The participants for this study were residential undergraduate students at a private, liberal arts university who enrolled in, and completed, a mentoring or study skills course during the 2014-2015 or 2015-2016 academic year. The host institution is a large, suburban university with a moderate selectivity rating. Non-probability sampling was employed to select an appropriate population for research as participants were not chosen randomly, but rather on the basis of their enrollment in one of the specified courses (Gall et al., 2007). All students who enrolled in the target courses during the 2014-2015 or 2015-2016 school year were included in the overall population rather than selecting a subset of applicable subjects. This broad inclusion allowed for

a larger overall sample size, and marginally increased the accuracy of the regression analysis (Warner, 2013). This more inclusive approach also helped to account for participant attrition incurred through data validation.

The target number of participants for a significant result was 616, as prescribed by Gall et al. (2007) for a correlational study to obtain a small effect size with statistical power of 0.7 at the .05 alpha level. The initial data produced a total of 2,017 total students who met the population criteria. This number was reduced to 1,505 due to participant incongruence (i.e., incomplete student information, student mortality and administrative dismissal from the institution).

The sample was derived from multiple sections of five unique courses taught by various professors throughout the target academic years, with the groups naturally occurring and divided by each predictor variable. Note that the potential variance across professors was not controlled in this study as it was not a focus of the research. These courses are promoted through one-on-one advising sessions, and are recommended especially for students who have experienced academic difficulty. Though all courses are considered elective in nature, students may be required to enroll in one or more courses if they are a part of a targeted population such as new NCAA athletes or students who are not in good academic standing according to their cumulative GPA.

For the purpose of this study, the stratification of groups was considered to be naturally occurring. The mentoring-based courses focus on small-group accountability and one-on one mentoring for life skills and academic resilience. The learning strategies-based courses focus on academic improvement techniques such as note-taking, self-motivation, time management and speed reading.

Instrumentation

Though moderately atypical, enrollment data's place in empirical research is well documented. The Department of Education's *What Works Clearinghouse* lists simple binary enrollment status (enrolled versus not enrolled) as a relevant outcome domain for postsecondary research (Institute of Education Sciences, 2015). Howard, McLaughlin, and Knight (2012) point to institutional data as a reliable instrument for use in predictive modeling, specifically as it pertains to at-risk student populations and retention-based studies. Similarly, Hagedorn (2005) recognizes simple binary analysis of enrollment data as a valid criterion for retention despite its limited scope. Further, recent studies (Boston, Ice, & Burgess, 2012; Freitas et al., 2015; Pike & Graunke, 2015) illustrate the integrity of institutional data for use in correlational research, including predictive analytics and at-risk analysis for use in undergraduate student retention initiatives. The use of institutional enrollment data also has several pertinent advantages in the context of this study. First, the data points used were collected through the institution's application process, eliminating the need for additional data collection. Similarly, because the data were gathered for a specific purpose and were sourced from a single student database, consistency was assured both for this study and for the institution's ongoing at-risk prediction practices.

For this study, student retention was measured by whether a student re-enrolled in a subsequent academic year, providing the student was eligible to return. This condition was evaluated on the basis of enrollment data provided by the institution through a formal request for data filed with their business information office. Due to the fact that this study has a binary result (retained or not retained), retention was determined by whether or not a student was enrolled in any courses for the corresponding fall term as of the institution's census date for the

beginning of the term. The researcher evaluated each disenrollment to ensure that it was not caused by mortality, degree completion or administrative removal. This measure (course enrollment) was further triangulated by the institution prior to submitting the data for review for accuracy with the offices of Financial Aid and the Bursar to ensure that further account activity had ceased.

Procedures

The predictor variables, gender, ethnicity and secondary school type (public or private) and criterion variable, subsequent academic year retention, was derived from the host institution's student database. Before obtaining this data, informal written permission was requested and obtained from the Dean of the academic department presiding over the courses that were used in this study. Next, informal written permission was obtained from the institution's Information Technology department for the extraction of the data. Once adequate permission was obtained, formal permission from the institution's Institutional Review Board was pursued and obtained through the official application process. See Appendix I for IRB approval.

With full IRB approval and the passing of the institution's census date for official enrollment calculation, the data was formally requested. The data request was made by submitting a formal data inquiry in accordance with the written procedures of the host institution. This request was submitted with a requested turnaround time of two weeks in accordance with the policies of the institution.

Once validated, subjects that were incongruent with the focus of the study were removed; specifically those students that were unable to continue their enrollment due to death or administrative dismissal. Once the data was considered to be correct and complete, it was coded

for use in IBM's Statistical Package for the Social Sciences software. For the purpose of this study, the criterion variable was coded with the number 0 for non-retained students, and the number 1 for retained students. For the first predictor variable (gender), 0 was used for female, and 1 was used for male. For the second set of predictor variables (ethnicity), 0 was used for Native American, 1 for Asian, 2 for African-American, 3 for Hispanic, and 4 for Caucasian. For the third set of predictor variables (secondary school type, 0 was used for a public school background, and 1 for private schools. Of note, the mentoring courses consist of small-group exercises focused on preparatory education for a successful transition to higher education, with a focus on self-management. The study-skills courses consist of exercised to establish and improve specific academic skills such as time management, self-motivation and note-taking. Once the data was considered correct and complete, it was uploaded into SPSS and the results were evaluated.

Data Analysis

To analyze the data and investigate the possibility of significant predictive relationships between the predictor variables of gender, ethnicity and secondary school type and the criterion variable of subsequent academic year retention, a logistic regression analysis was considered suitable (Gall et al., 2007). The total count of 1,505 participants exceeded the 616 participants required in order to both achieve predictive capability and to obtain a small effect size with statistical power of 0.7 at the .05 alpha level (Gall et al., 2007). This analysis was appropriate to investigate the research question as the criterion variable is binary, and the research question involved multiple predictor variables (Warner, 2013). The analysis was run at a 95% confidence interval. The following section highlights the various assumption tests and model fit analyses as they relate to the validity of this study.

Assumption Testing

Assumptions for logistic regression are limited in comparison to linear regression due to the method's independence from linear relationships and ordinary least squares algorithms (Chen, Ender, Mitchell, & Well, 2003). Similarly, due to the reliance of logistic regression's practical significance on model fit diagnostics, the importance of preliminary assumption testing is significantly mitigated. As a result, both multicollinearity and the data's specification errors were able to be assessed within the SPSS output (Chen et al., 2003; Warner, 2013). The absence of multicollinearity was evaluated within the collinearity diagnostic tables to ensure that the predictor variables were not highly correlated, whereas specification errors were assessed within the Model Fit analysis to ensure that the predictors used were appropriate (Chen et al., 2003; Warner, 2013).

Data Screening

In order to assess the validity of the results, several independent assessments were conducted, beginning with the model fit output. First, because multiple predictor variables were included in this study, odds ratios were assessed to evaluate the change in odds for each variable. This analysis was included to ensure accuracy in the interpretation of the aggregated regression results (Chen et al., 2003).

Similarly, proportionality of dependent outcomes was monitored to ensure that the results can be considered statistically meaningful because criterion variable distribution was a significant contributor to model fit in logistic regression (Warner, 2013). Finally, residual analysis was assessed in order to gain a clear understanding of the effect of outlying variables as they relate to the overall fit of the model. Assessing the difference between the predicted and

observed value of the criterion variable was a key step in ensuring an appropriate model fit (Sarkar, Midi, & Rana, 2011).

Data Entry Method

Because both predictive significance and overall model fit are the primary focuses of logistic regression analysis, SPSS provides multiple approaches for entering variables into the model. The most common approach (used in this study) is referred to as the "enter" method, and aggregates all logits into a single package for analysis, with options for both the main effect and the interaction effect available within SPSS. Although other entry approaches such as the forward and backward method are considered valid, Warner (2013) notes that these tertiary methods increase the risk of a Type I error.

CHAPTER FOUR: FINDINGS

Overview

The purpose of this quantitative study was to assess the predictive significance of pre-matriculation variables on institutional retention for undergraduate students after participating in a developmental course at a private, liberal arts university. The analysis examined archived student data for qualifying undergraduates collected from a two-year time period. The following sections detail specific statistical findings obtained through multiple binary logistic regression analyses. The predictor variables included were gender, ethnicity and secondary school type (public or private). The likelihood-ratio was used to test the statistical significance of each prediction model as a whole. The Cox and Snell and Nagelkerke's pseudo R^2 values were used to assess the strength of prediction for each model. The Wald chi-squared test was examined to assess the statistical significance of each unique predictor variable. Finally, odds ratios were used to summarize and interpret the outcome of each variable in the models. Descriptive statistics are provided to supplement the broader narrative of the study, with emphasis on population demographics as a focus of research. Assumption testing is outlined, as well as model fit diagnostics due to their relevance to binary logistic regression findings.

Research Questions

RQ1: Can gender predict the year-to-year retention of residential undergraduate students who complete developmental coursework at a private, liberal arts university?

RQ2: Can ethnicity predict the year-to-year retention of residential undergraduate students who complete developmental coursework at a private, liberal arts university?

RQ3: Can secondary school type predict the year-to-year retention of residential undergraduate students who complete developmental coursework at a private, liberal arts

university?

Null Hypotheses

H₀1: Gender does not significantly predict the year-to-year retention of residential

undergraduate students who complete developmental coursework at a private, liberal arts

university.

H₀2: Ethnicity does not significantly predict the year-to-year retention of residential

undergraduate students who complete developmental coursework at a private, liberal arts

university.

H₀3: Secondary school type does not significantly predict the year-to-year retention of

residential undergraduate students who complete developmental coursework at a private, liberal

arts university.

Descriptive Statistics

This study used data from 1,505 total students who completed a developmental course at

the host institution during the 2014-2016 academic years. Each of the predictor variables were

categorical in nature, thus frequency counts were calculated and examined. A basic summary of

the statistics for criterion and predictor variables by group can be found in Table 1.

Table 1

Descriptive Statistics
Criterion Variable: Subsequent Academic Year Retention

Variable	Retained		Did not Retain		N
Male	586	(66%)	302	(34%)	888
Female	404	(66%)	213	(34%)	617
Native-American	22	(60%)	16	(40%)	38
Asian	58	(71%)	24	(29%)	82
African American	227	(60%)	147	(40%)	374
Hispanic	22	(69%)	9	(31%)	31
Caucasian	661	(68%)	319	(32%)	980
Public	657	(64%)	375	(36%)	1032

Private	333 (70%)	140 (30%)	473

Results

Data Screening

In preparation for use in SPSS, the data file was scanned for missing data, abnormalities or factors that may disqualify a participant or damage the integrity of the data. Each variable was assessed for integrity, and deemed intact. Similarly, tertiary and superfluous data points were removed from each participant.

All categorical variables were coded for use in SPSS. The gender variable was coded as 0 – female, 1 – male. The ethnicity variable was coded as 0 – Native American, 1 – Asian, 2 – African American, 3 – Hispanic, 4 – Caucasian. The third predictor variable, secondary school type, was coded as 0 – Public, 1 – Private. The criterion variable of retention was coded as 0 – Did not retain, and 1 – Did retain.

Assumptions

Logistic regression requires compliance with a limited set of assumption tests prior to analysis. First, the technique requires a dichotomous criterion variable (Warner, 2013). Because the criterion variable of interest in this study was expressed as a simple binary outcome (yes or no), the first assumption was intact. The second assumption was that of the absence of multicollinearity for all predictor variables. Because each variable in this study was categorical as opposed to linear or ordinal, the data also passed this test. Finally, logistic regression utilizes the maximum likelihood estimation (MLE) method for estimating the parameters of a given model. Though MLE allows for a minimum N of 5 participants per cell, 10 cases per predictor variable is recommended (Warner, 2013). In evaluating the data, it was determined that each variable had at least ten cases. As a result, all assumptions were satisfied.

Results for Null Hypothesis One

A binary logistic regression analysis was conducted to predict the year-to-year retention

of students by gender who completed a developmental course at a four-year institution at the

95% confidence level. The predictor variable was gender. The results of the logistic regression

for Null Hypothesis One were determined to not be statistically significant, $X^2(1) = .043$, $p =$

.837. See Table 2 for the Omnibus Tests of Model Coefficients.

Table 2

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	.043	1	.837
	Block	.043	1	.837
	Model	.043	1	.837

Similarly, the strength of the association between gender and retention was determined to be

extremely weak according to Cox and Snell's R^2 (.000) and Nagelkerke's R^2 (.000). This result

provides evidence that less than .01% of the variance in the criterion variable is being affected by

gender. The Model Summary can be found in Table 3.

Table 3

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	1933.820[a]	.000	.000

a. Estimation terminated at iteration number 3
because parameter estimates changed by less than
.001.

The model was further analyzed for predictive significance using the Wald chi-squared test and the odds ratios produced from the analysis. The Wald chi-squared test for gender was not significant, $X^2(1) = .043$, $p = .837$. This result indicates that there was not a statistically significant difference in the odds of retention for male versus female students, and thus the researcher failed to reject the null hypothesis. Further, the odds ratios were examined to measure association between the predictor and criterion variables. Exp(*B*) for gender was 0.977, indicating that the odds of retention for female students was marginally lower than that of males. This difference is too small to be considered statistically significant as demonstrated by the nonsignificant Wald chi-squared test (Warner, 2013). Table 4 provides a summary of the Wald chi-squared statistics, odds ratios, and 95% confidence interval.

Table 4
Variables in the Equation

	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1ª Gender(1)	-.023	.110	.043	1	.837	.977	.787	1.214
Constant	.663	.071	87.575	1	.000	1.940		

a. Variable(s) entered on step 1: Gender.

Results for Null Hypothesis Two

A binary logistic regression analysis was conducted to predict the year-to-year retention of students by ethnicity who completed a developmental course at a four-year institution at the 95% confidence level. The predictor variable included in this model was ethnicity, (delineated by Native American, Asian, African American, Hispanic, and Caucasian. The results of the logistic regression for Null Hypothesis Two were determined to not be statistically significant, $X^2(4) = 7.742$, $p = .102$. See Table 5 for the Omnibus Tests of Model Coefficients.

Table 5
Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	7.742	4	.102
	Block	7.742	4	.102
	Model	7.742	4	.102

Similarly, the strength of the association between ethnicity and retention was determined to be extremely weak according to Cox and Snell's R^2 (.005) and Nagelkerke's R^2 (.007). This result shows that less than 0.1% of the variance in the criterion variable is being affected by ethnicity. The Model Summary can be found in Table 6.

Table 6
Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	1926.121[a]	.005	.007

a. Estimation terminated at iteration number 3 because parameter estimates changed by less than .001.

The model was further analyzed for predictive significance using the Wald chi-squared test and the odds ratios produced from the analysis. The Wald chi-squared test for ethnicity was not significant, $X^2(4) = 7.785$, $p = 0.100$, indicating that there was not a statistically significant difference in the odds of retention by ethnicity as an overall model, and thus the researcher failed to reject the null hypothesis. Two of the five ethnicities however were statistically significant in predicting retention. The Wald test for African American was $X^2(1) = 5.453$, $p = .020$, indicating a significant predictive relationship. Similarly, the Wald chi-squared test for Caucasian (constant) was $X^2(1) = 114.209$, $p = .000$, indicating another significant predictive

relationship. Because the overall model was not significant however, caution should be taken when interpreting these results.

Further, the odds ratios were examined to measure association between the predictor and criterion variables. Exp(B) for each ethnicity was as follows: Native American, 0.664; Asian, 1.166; African American, 0.745; Hispanic, 1.180; Caucasian, 2.072. These results indicate discernable differences in the odds of retention by ethnicity, though the model overall was too small to be considered statistically significant as demonstrated by the nonsignificant Wald test. Individually, the significance of the African American (Ethnicity (3) and Caucasian (Constant) Wald chi-squared tests indicate a significant difference in retention between the two populations. Table 7 provides a summary of the Wald statistics, odds ratios, and the 95% confidence intervals.

Table 7
Variables in the Equation

	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1ᵃ Ethnicity			7.785	4	.100			
Ethnicity(1)	-.410	.336	1.494	1	.222	.664	.344	1.281
Ethnicity(2)	.154	.252	.372	1	.542	1.166	.712	1.912
Ethnicity(3)	-.294	.126	5.453	1	.020	.745	.582	.954
Ethnicity(4)	.165	.402	.169	1	.681	1.180	.537	2.591
Constant	.729	.068	114.209	1	.000	2.072		

a. Variable(s) entered on step 1: Ethnicity.

Results for Null Hypothesis Three

A binary logistic regression analysis was conducted to predict the year-to-year retention of students by secondary school type who completed a developmental course at a four-year institution at the 95% confidence level. This model included the predictor variable school type

(delineated by Public and Private). The results of the logistic regression for Null Hypothesis

Three were determined to be statistically significant, $X^2(1) = 6.632$, $p = .010$. See Table 8 for

the Omnibus Tests of Model Coefficients.

Table 8
Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	6.632	1	.010
	Block	6.632	1	.010
	Model	6.632	1	.010

The strength of the association between school type and retention was determined to be weak

according to Cox and Snell's R^2 (.004) and Nagelkerke's R^2 (.006). This result provides

evidence that despite the significant result, less than .01% of the variance in the criterion variable

is being affected by school type. The Model Summary can be found in Table 9.

Table 9

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	1927.230[a]	.004	.006

a. Estimation terminated at iteration number 3
because parameter estimates changed by less than
.001.

The model was further analyzed for predictive significance using the Wald chi-squared

test and the odds ratios produced from the analysis. The Wald chi-squared test for school type

was statistically significant, $X^2(1) = 6.521$, $p = .011$. This result indicates that there was a

statistically significant difference in the odds of retention for public school versus private school

students, and thus the null hypothesis was rejected. Further, the odds ratios were examined to

measure association between the predictor and criterion variables. Exp(B) for school type was

1.358, indicating that the odds of retention for private school students was 1.4 times more likely than that of public school graduates. This difference is large enough to be considered statistically significant as demonstrated by the significant Wald chi-squared test. Table 10 provides a summary of the Wald chi-squared statistics, odds ratios, and 95% confidence interval.

Table 10

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1[a]	School_Type (1)	.306	.120	6.521	1	.011	1.358	1.074	1.717
	Constant	.561	.065	75.070	1	.000	1.752		

a. Variable(s) entered on step 1: School_Type.

CHAPTER FIVE: CONCLUSIONS

Overview

A logistic regression was conducted to examine predictive relationships among commonly researched student factors (gender, ethnicity, secondary school type) and subsequent academic year retention for residential undergraduate students that completed a developmental education course. A logistic regression analysis was conducted for each predictor variable to assess the significance of each predictive relationship. The following sections analyze the specific statistical findings obtained through each analysis.

Discussion

The purpose of this quantitative, correlational study was to determine if year-to-year retention can be predicted by the pre-matriculation factors of gender, ethnicity and secondary school type in a logistic regression for residential undergraduate students who completed a developmental course in a private, liberal arts university. Specifically, this research aimed to determine if a student's gender, ethnicity or secondary school setting hold predictive significance for year-to-year institutional retention after the student engages in one of two developmental courses. Research has shown direct parallels between each predictor variable's population membership and varying rates of collegiate success, and remediation for potential issues associated with each population has been recommended in several studies. Because views of student risk and undergraduate attrition are considered attributable to a variety of student factors, three separate analyses were conducted to assess the predictive significance between each factor individually.

Research Question One (Gender)

Research question one examined if gender could predict the year-to-year retention of residential undergraduate students who complete developmental coursework at a private, liberal arts university. Research on gender trends in higher education retention reveals that female students have, as an aggregate, outperformed by males over the past several decades in U.S. higher education in terms of degree completion (Barrow, Reilly, & Woodfield, 2009; National Center for Education Statistics, 2016; Wirt et al., 2004). Though year-to-year retention rates by gender vary by institution and program, aggregate female supremacy in persistence and eventual degree completion in the U.S. has been sufficiently established. In traditionally male dominated programs such as agriculture and STEM, however, female retention has lagged behind males consistently (Archibeque-Engle & Gloeckner, 2016; Baskin, 2012; Woodfield & Earl-Novell, 2006). For remediation such as developmental education to adequately promote the year-to-year retention of both populations, research indicates that males benefit from mentoring and study skills development (Cabrera et al, 1993; Camera, 2015; Campbell & Mislevy, 2013), whereas females benefit from establishing clear academic and career goals (Ackerman et al., 2013; Smith & White, 2015).

The logistic regression analysis for gender revealed a non-significant chi-squared result ($p = .837$), indicating that gender was not a statistically significant predictor of retention for students after engaging in a developmental course. Correspondingly, model fit diagnostics revealed extremely low explanatory percentages for the model of gender (less than .01), indicating that less than one percent of the variance in the outcome (subsequent academic year retention) was being predicted by the variable of gender. In addition, the odds ratios for both genders were examined to measure a potential association between the predictor and criterion

variables. The odds ratio for females was 0.977, indicating that the odds of retention for female

students in the study was marginally lower than that of males.

The results of the odds ratios show that, for students who engage in a developmental

course, the risk of attrition by gender is nearly equal, favoring males slightly. These results

contrast with both national statistical norms in the U.S. and reported institutional averages, which

show a consistent advantage to females in retention and eventual degree completion Barrow,

Reilly, & Woodfield, 2009; National Center for Education Statistics, 2016; Wirt et al., 2004).

Research indicates that a strong alignment between student need and institutional intervention

can remediate risk factors and promote year-to-year retention (Camera, 2015; Engle & Tinto,

1997; Seirup & Rose, 2011); a consideration that may help to explain the lack of predictive

significance for the gender variable, though further research is recommended to explore this

prospect.

In relation to this study's broader theoretical framework, the statistical results of the

regression analysis conflict with Tinto's (1993) evolved work with engagement theory in

accounting for gender as an important predictor variable for retention. The comparable odds

ratios for each gender indicate that these populations are similar to one another in their retention

upon taking a developmental course; a notable departure from Tinto's findings and observed

national trends in American higher education. Engle and Tinto (2007) did note that alignment

between institutional support and a perceived deficiency was critical to the success of each at-

risk population, and that appropriately designed remediation could help to promote retention

above the population's traditional performance. Though more mature indicators such as GPA

improvement or eventual degree completion fall outside of the scope of this study, the results of

the logistic regression conclude that gender does not significantly predict the year-to-year

retention of residential undergraduate students who complete developmental coursework at the host institution.

Research Question Two (Ethnicity)

The second research question explored whether ethnicity can predict the year-to-year retention of residential undergraduate students who complete developmental coursework at a private, liberal arts university. Underrepresented minorities remain an underserved population in higher education, as evidenced by lagging retention and graduation rates and higher levels of student borrowing (Camera, 2015; Knaggs, Sondergeld, & Schardy, 2015; Musu-Gillette et al., 2016). Research suggests that, unlike a risk category with more direct implications such as High School GPA or chronic absenteeism, ethnicity speaks less to a specific deficiency and more to factors associated with sub-populations such as low SES, first-generation college student status or insufficient K-12 preparatory education (Knaggs et al., 2015; Reason, 2009; Talbert, 2012). Suggested remediation to promote retention among this population includes service learning, undergraduate research activities (O'Donnell et al., 2015), population-focused developmental coursework (Camera, 2015), peer-mentoring (Camera, 2015; O'Donnell et al., 2015) and enhanced pre-matriculation preparation (Knaggs et al., 2015).

The logistic regression analysis for ethnicity revealed a non-significant chi-squared result ($p = .102$), indicating that ethnicity as a model was not a statistically significant predictor of retention for students after engaging in a developmental course. Congruently, model fit diagnostics revealed extremely low explanatory percentages for the ethnicity model (less than .01), demonstrating that less than one percent of the variance in the outcome (subsequent academic year retention) was being predicted by the variable of ethnicity as a whole. A Wald chi-squared test was conducted to analyze the individual ethnicities contained within the model

for predictive significance. Two of the five ethnicities were found to be statistically significant in predicting retention. The Wald chi-squared tests for African American ($p = .020$) and Caucasian (.000) produced significant results, indicating a significant predictive relationship for each. Finally, odds ratios for each ethnicity with predictive significance were examined to measure a potential association between the predictor and criterion variables. The odds ratio for African American compared to the constant (Caucasian) model was 0.745, indicating that the odds of retention for African American students in the study were notably lower than that of their Caucasian classmates.

The results of the odds ratios show that, for students who engage in a developmental course, the risk of attrition by ethnicity is varied. Of the statistically significant Wald chi-squared results, odds ratios showed a considerable divide between the response to intervention in terms of retention for African American students compared to Caucasian students. This result corresponds with IPEDS data that shows the retention of underrepresented minority groups consistently lagging behind that of Caucasian students in the U.S. (Camera, 2015; Musu-Gillette et al., 2016), as well as trends comparing both year-to-year retention and degree completion of various ethnic populations (Camera, 2015; Payne, Slate, & Barnes, 2013). Of interest, the odds ratio for the non-statistically significant Hispanic group showed retention above that of Caucasian students; a finding that is also in contrast to the statistical averages observed across U.S. higher education (Camera, 2015; Musu-Gillette et al., 2016). Because the population sample size was limited ($n = 31$) and the overall model for ethnicity was not significant, caution should be taken when interpreting these results.

As it relates to this study's theoretical framework, Bandura's (1977; 1986) social learning theory acknowledges the impact of past and present experiences on efficacy and academic

performance, and emphasizes the effects of the learning environment on a student's socio-cognitive abilities. Academic achievement gaps among underrepresented minority groups have traditionally been attributed to a number of environmental factors such as subpar K-12 urban schooling, minimal home literacy activities, first-generation college status and socioeconomic status (Cook, 2015; Knaggs et al., 2015; O'Donnell et al., 2015; Payne, Slate, & Barnes, 2013). From this perspective, the varying odds ratios produced for each ethnicity within the model affirm this theory in the context of the literature. The odds ratio for African American students indicated a less likely prediction for retention; however, the practical difference in retention shown in the descriptive statistics between African American students and Caucasian students was only eight (8) percentage points: a finding that represents a significant improvement over U.S. national achievement gap of 50% for these populations reported by IPEDS (Cook, 2015).

Within social learning theory is also hope for improvement with this population as mentoring and preparatory programming have shown to improve educational outcomes among those with similar demographic characteristics (Camera, 2015; Knaggs et al., 2015; O'Donnell et al., 2015). Though two ethnicities produced significant predictive results and provided insight into each population, failure to reject the null hypothesis indicates that the variable of ethnicity was insufficient to significantly predict the retention of undergraduate students who completed a developmental course. These findings indicate a weakness in the variable of ethnicity for predicting student retention after completing a developmental course, as well as a potential opportunity for improvement in the retention of underrepresented minority students through more population-specific design in the developmental coursework.

Research Question Three (Secondary School Type)

Research question three examined if secondary school type could predict the year-to-year retention of residential undergraduate students who complete developmental coursework at a private, liberal arts university. Current literature notes several variances in outcomes for students on the basis of educational setting and context, with an emphasis on students over institutions, and resources over methods. Research has revealed a discernable advantage for graduates of private schools in terms of standardized test scores, aggregate educational attainment and postsecondary participation (Altonji, Elder, & Tabor, 2005; Frenette & Chan, 2015). Though this achievement gap has been theorized to relate more directly to the profile of the students rather than the quality or pedagogy of the schools themselves, the differences have shown to equate to a sizeable opportunity gap (Altonji et al., 2005).

Public school attendees as an aggregate have traditionally held notable disadvantages in in socioeconomic status and familial educational attainment (Frenette & Chan, 2015); two characteristics that have correlated negatively with academic achievement in numerous studies (Camera, 2015; Rigali-Oiler & Kurpius, 2013). Though private school graduates have held a statistical advantage in postsecondary outcomes, public school graduates typically benefit from more diverse course offerings and varied opportunities for academic advancement such as Advanced Placement and exposure to diversity (Ackerman, Kanfur, & Beier, 2013). Both school types can provide advantages to students depending on individual learning needs and educational aspirations.

The logistic regression analysis for secondary school type revealed a significant chi-squared result ($p = .010$), indicating that secondary school type was a statistically significant predictor of retention for students after engaging in a developmental course. Despite the significance of the variable's chi-squared analysis, model fit diagnostics revealed that less than

.01% of the variance in the criterion variable (subsequent academic year retention) was being affected by school type, indicating an extremely weak model. Finally, the odds ratios were examined to measure a potential association between the predictor and criterion variables. The Wald chi-squared for private school students was 1.358, indicating that the odds of retention for private school attendees was nearly 1.4 times greater than that of public school graduates who were exposed to the same intervention.

The results of the odds ratios show that, for students who engage in a developmental course, private school graduates hold a notable advantage in terms of year-to-year retention. These results conflict with a 2003 report from the National Center for Education Statistics which found that educational outcomes for each population were statistically equal (Peterson & Llaudet, 2007). That study however controlled for demographic differences in attendees, which highlights the significance of the associated risk factors related to secondary school type. Conversely, this study affirms the findings of Rose's (2013) logistic regression analysis of academically high-achieving African American males, which revealed a decreased probability of bachelor's degree attainment for urban school graduates over those attending private schools. Rose's (2013) findings are consistent with reported U.S. academic achievement trends for urban school attendees and students with low SES (Camera, 2015). The results also concur with the Wenglinsky Report for the Center on Education Policy (2007), which revealed a considerable advantage for private school graduates in terms of their aggregate academic achievement over time.

In relation to the theoretical framework of this study, these findings align with Bean's (1980) contextually-based student experience model in affirming the significance of secondary school type in the prediction of student retention. Bean's (1980) model asserted that a student's

prior learning experiences factored into their ability to persist at the undergraduate level, and that secondary school context and socioeconomic status should be factored into the evaluation of a student's risk factors. Research indicates that the discrepancy in achievement between the two school types is attributable largely to student demographics (Altonji et al., 2005; Frenette & Chan, 2015;) a factor shared by the ethnicity variable (Knaggs et al., 2015; Reason, 2009; Talbert, 2012). The rejection of the null hypothesis on account of the significant chi-squared result and the wide-ranging odds ratios indicates that secondary school type was a significant predictor of retention, and can be used by the institution as a data point to manage enrollment and refine existing retention initiatives.

Implications

Each model varied in significance and applicability, but provided important insight into the variables' ability to significantly predict the retention of students who completed the designated coursework. Developmental coursework is used widely across the United States, with varied intents and designs. A common approach is to provide general academic skill development, with the assumption that foundational improvement will provide the student with the confidence, efficacy or resources required to promote retention (Conway, 2011; Hoops et al., 2015; Pryjmachuk et al., 2014). The courses included in this study, though general in nature, align with prescribed best practices for academically deficient students, which also coincide with prescribed remediation for specific populations as described by Campbell and Mislevy (2013).

The logistic regression analysis for gender did not hold predictive significance, and proved to be a weak model overall for predicting the retention of students who completed the developmental courses. These findings also present a result that contrasts with gender-specific undergraduate retention trends in the U.S. observed over the last 30 years. It also diminishes the

variable of gender as a meaningful risk factor for the institution's enrollment-based prediction models, and provides minimal empirical value for the refinement of the developmental coursework.

This contrasting observation may indicate an element within the developmental coursework that is providing needed remediation for males, or that otherwise promotes retention above what would be expected for the population. Campbell and Mislevy's (2013) findings indicate that improvements in the area of study skills lowers the risk for male attrition, but does not hold predictive significance for the retention of female students. The authors note a correlation between female student's confidence in relation to academic and career goals and their persistence: a theme echoed by Ackerman, Kanfer and Beier (2013) in relation to female enrollment and persistence in STEM programs. With historical persistence figures favoring females on a consistent basis in contrast to the findings of this study, greater opportunities for promoting female retention may exist through refinement of the coursework. Further research is recommended to determine the specific effectiveness of the coursework in promoting year-to-year retention.

The ethnicity model produced a similarly non-significant chi-squared result and weak model fit diagnostic, indicating that the variable could not significantly predict retention for the target population. This finding demonstrates that ethnicity would not be a useful variable in the institution's student retention risk analyses for enrollment management purposes. It could, however, provide insight into potential opportunities for improvement within the design of the coursework. Significance for African American and Caucasian students emerged, revealing a significant difference in the odds of retention in favor of Caucasian students. This conclusion is

in line with prior studies, and affirms the need for population-based assessment and course development to attempt to meet the needs of all students.

Of interest, the odds ratio for the non-statistically significant Hispanic group showed retention above that of Caucasian students; a finding that is also in contrast to the statistical averages observed across U.S. higher education (Camera, 2015; Musu-Gillette et al., 2016). This result aligns with the findings of O'Donnell et al. (2015) who discovered opportunities for improved retention of undergraduate Latino students through elective programs focused on service-learning and mentoring. Though the population sample size was limited ($n = 31$), the results provide insight to the institution as to a potentially effective alignment between the remediation provided in the developmental courses and the needs of the population to promote retention, and merits further research.

Finally, the secondary school type variable produced the study's only statistically significant model despite a weak overall model fit. The odds ratios indicated that the odds of retention for private school graduates was 1.4 times greater than for public school graduates, which represents a meaningful finding for the institution's enrollment and retention efforts. This outcome is historically consistent with other studies (Altonji, Elder, & Tabor, 2005; Frenette & Chan, 2015), and is commonly attributed to the existence of urban and underserved school systems within the public school population (Frenette & Chan, 2015; Rose, 2013). Two empirically derived remediation approaches for students with insufficient K-12 preparation is transition programming and mentoring (Camera, 2015; Rigali-Oiler & Kurpius, 2013), both of which were provided in the developmental coursework. Despite these provisions, the logistic regression analysis produced a significant chi-squared result and a notable difference in odds

ratios, indicating that year-to-year retention could be predicted on the variable of secondary school type.

On the basis of these findings, it is apparent that logistic regression analysis can provide insight for an institution when extended from the identification of general student risk to certain populations' response to intervention initiatives. Direct correlations between the coursework and students' retention cannot be determined from the predictive significance of a given variable in the context of this study; however these findings can assist the institution in refining the prediction of enrollment trends, and can provide insight to stakeholders of inequities within the response to intervention for specific populations. Though meaningful at several levels, this study encountered several limitations which are outlined below.

Limitations

A limitation of this study is its application to other populations. The sample was taken from residential students who participated in a developmental course at a private, liberal arts institution, and may not be applicable to students attending a public institution with alternative resources, state guidelines, enrollment mandates and missions. Applicability may also be limited to residential populations as online and adult learners introduce a varied set of inherent risk factors that have been found to confound traditional definitions of risk (Cochran, Campbell, Baker, & Leeds, 2014). Also, it cannot be assumed that each institution's developmental coursework will be similar, or will contain the same elements that may promote year-to-year retention. The coursework used in this study was general in nature (not population-specific) and included students from all academic levels and departments. The mentoring-based courses focused on small-group accountability and one-on one mentoring for life skills and academic resilience, whereas the study skills-based courses focused on academic improvement techniques

such as note-taking, time management and speed reading. Though these are common elements in developmental courses (Hoops, Yu, Burridge, & Wolters, 2015), they are not represented in all developmental coursework by default.

A second limitation is in the narrow focus of year-to-year retention. Though the measure has been validated in multiple applications (Howard, McLaughlin, & Knight, 2012; Kassak, Kopman, & Bielikova, 2016; Whalen, Saunders, & Shelley, 2010), it limits the scope of the findings to a brief snapshot in the student life cycle as opposed to a more robust analysis of eventual degree completion or number of terms completed. Though limiting in terms of impact, the narrow focus of immediate retention was considered impactful for this study as student success is considered a term by term endeavor (Raisman, 2011).

A third limitation lies in the assessment of risk factors (predictor variables) as stand-alone determiners of each population's response to intervention. Student risk analysis has shown to be a complex, multi-faceted endeavor which typically assesses a multitude of factors in assigning categorical or population-specific risk (Rigali-Oiler & Kurpius, 2013; Rose, 2013). The use of single risk factors in this study, as well as the individual assessment of each population in the logistic regression model, were selected due to the focus of this research. Because the implications of this study are aimed at assessing population-specific responses to developmental education for the purpose of assessing the promotion of retention, stand-alone population-based risk factors were considered more important than the combination of risk factors unique to students as individuals.

Recommendations for Future Research

The results of this study provided necessary insight into the practical significance of extending risk analysis from identification to intervention. For the continued development of

these concepts, several recommendations for future research are proposed based on the results and limitations of this study.

1. Replications of this study should be conducted in a variety of institutional settings, including public, online, hybrid, international, technical, non-faith-based and community college.

2. Replications of this study should be conducted using alternative student risk factors such as incoming GPA, standardized test scores, distance from the institution, first-generation college student status, SES, percent of institutional aid, intended major and the number of credits transferred.

3. A qualitative alternative should be conducted to assess the participants attitudes and perceptions of the coursework from each risk population.

4. A longitudinal companion study should be conducted to assess the total terms retained and eventual degree completion result of each student's retention.

5. This study should be repeated after risk-specific adjustments are made to the developmental course.

6. A replication of this study should be conducted using an ethnically diverse faculty in the developmental courses as a means of promoting the retention of underrepresented minority students. This recommendation is in accordance with Ahmad and Boser's (2014) research noting the potential for a negative learning environment created for underrepresented minority students by a lack of faculty diversity in secondary and post-secondary settings.

7. A similar study that assesses the results of the study skills course and the mentoring course separately should be conducted. The results of this study would help to distinguish

the elements of each course that are particularly impactful in the promotion of retention for each population.

8. A casual comparative study should be conducted to compare the results of this study with the predictive significance of the variables for students who did not complete a developmental course.

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APPENDIX I: IRB Exemption Letter

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

8/24/2016

Michael Thomas Shenkle
IRB Exemption 2601.082416: Informed Attrition Intervention: A Logistic Regression Analysis of Educational Experience Factors for the Development of Individualized Best Practices in Higher Education Retention

Dear Michael Thomas Shenkle,

The Liberty University Institutional Review Board has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and no further IRB oversight is required.

Your study falls under exemption category 46.101(b)(4), which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46:101(b):

> (4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

Please note that this exemption only applies to your current research application, and any changes to your protocol must be reported to the Liberty IRB for verification of continued exemption status. You may report these changes by submitting a change in protocol form or a new application to the IRB and referencing the above IRB Exemption number.

If you have any questions about this exemption or need assistance in determining whether possible changes to your protocol would change your exemption status, please email us at irb@liberty.edu.

Sincerely,
Administrative Chair of Institutional Research
The Graduate School