ASSESSING THE INFLUENCE OF COMMUNITY COLLEGE COURSE SELECTION PATHWAYS ON TRANSFER STUDENT PERSISTENCE: A MODEL FOR COMPARATIVE EVALUATION

by

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DEDICATION

To Placido and Elidia, for their dedication to education and their family.

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ABSTRACT

The present study examined the impact of pre-transfer characteristics with a focus on course selection decisions at the community college, demographic variables including age, ethnicity and gender, and post-transfer college academic characteristics on variables for transferability of credits and two-year persistence. The sample included 2,006 transfer students entering a large public four-year institution from two of the top feeder community colleges over a period of four years. National Student Clearinghouse records and transcript analysis were used to code the percent of community college credits accepted for credit and enrollment two years following the first semester of matriculation at the four-year university as exogenous variables. Community college records were coded into categories corresponding to three "pathways" to transfer: completion of state-mandated core coursework, attainment of an associate degree prior to transfer, and alignment of coursework with major-specific pre-requisites included in transfer planning guides prepared by the four-year institution.

A hypothesized path model developed based on the literature for community college transfer was not supported by the data. Kruskal-Wallis H test and logistic regression analyses were used to identify significant predictor variables for credit transfer and two-year persistence, including comparative analyses for the three pathways. Ethnicity and gender were not significant predictors of two-year persistence. Significant differences in persistence were found for class level and age at the time of transfer and multiple group analysis methods were used to sub-divide the sample. Results revealed that of the three pathways, only coursework alignment with transfer planning guides was a significant predictor for persistence. Other variables significant in predicting persistence included course completion ratio, transfer shock in the first semester, and transfer GPA. Findings for persistence varied across age groups and class level at matriculation.

I. INTRODUCTION

While researching this paper, I was asked to provide guidance to a student ("Andrew") on his plan to attend community college and transfer to a four-year university in order to complete a baccalaureate degree. I opened the conversation by asking Andrew about his degree choice and the university where he planned to transfer. Andrew said he had completed a general education diploma (GED) and began community college in Florida in spring 2017. Encouraged by his uncle, Andrew set a goal of transferring to obtain a baccalaureate degree in computer science at a large four-year public university in Florida. When asked if he spoke with an advisor or looked at the admission or degree requirements for his target program prior to selecting courses, he said he had not. We found the program website and printed out these requirements. I suggested that an advisor at his community college would be in the best position to understand specific transfer requirements and should be able to assist him in developing a transfer plan.

We then discussed when he expected to transfer. Based on his low grade point average (GPA) in high school (he stopped attending after his mother passed away and his father became ill), we determined that his best path would likely be to take advantage of the state policy guaranteeing transfer for students who complete an associate degree. According to the target university website, if he transferred prior to earning the associate degree, his high school GPA would be factored into the admissions decision.

Andrew said he planned to work full-time at his pizza delivery job while attending college part-time. He had a Pell grant from financial aid, but did not take out any loans, and was counting on his job for income to cover expenses. I urged him to seek

more financial aid if needed in order to enroll full-time, noting that at six credits per semester, it would likely take four years to earn an associate degree, and at least six years to obtain a baccalaureate degree. Two weeks later, Andrew responded that he met with an advisor and reworked his schedule. He still planned to attend college part-time in the spring, but would pursue financial aid in order to enroll full-time in subsequent semesters.

Andrew is one example of the common obstacles to successfully navigating the path from community college through transferring to a four-year institution to complete a baccalaureate degree. Most students who enroll in a community college expect to transfer to a four-year institution to continue their studies (Doyle, 2006). However, only approximately 14% of students who enroll at a community college complete a baccalaureate degree (Doyle, 2009). Many complex factors impact this gap between aspirations and outcomes.

Like Andrew, students who do not seek advising to assist with course selection risk earning credits that will not transfer toward their four-year degree. Research has demonstrated a negative relationship between the number of non-transferable credits earned, and the likelihood of baccalaureate graduation (Monaghan & Attewell, 2015). According to self-reported responses to the 2012 Survey of Entering Student Engagement at Austin Community College, only one-half of students indicated that an advisor assisted them in creating a plan for achieving their academic goals.

Many community college students also face challenges outside of school that impact enrollment decisions and course scheduling. Almost two-thirds of students enroll part-time in community college and many work full-time (Orozco & Cauthen, 2009).

Decisions by community college students who enroll beyond the traditional college age (18 to 21) often reflect responsibilities associated with adult life, including caring for dependents. Community college students are much more likely to be non-traditional; about one-half are 25 or older, and approximately one-third have dependents (Juszkiewicz, 2014). Non-traditional students now comprise 40% of all higher educational students (Chao, DeRocco, & Flynn, 2007).

Despite the efforts of policymakers to strengthen the transfer pathway in the last four decades, the rate of baccalaureate degree completion among transfer students has remained steadily below 30% (Townsend, 2002). In fact, research shows that beginning higher education at a community college lowers the probability of achieving this goal as much as 15-40% compared to students with comparable academic preparation who begin at a four-year institution (Doyle, 2009; Long & Kurlaender, 2009). This finding remains even after controlling for selection bias and other variables negatively associated with degree completion (Alfonso, 2006; Reynolds, 2012; Reynolds & DesJardins, 2009; Sandy, Gonzalez, & Hilmer, 2006; Stephan, Rosenbaum & Person, 2009).

The impact of initial college selection on baccalaureate degree completion is especially alarming considering its disproportionate effect on students from underserved communities. Among low-income students from underrepresented racial and ethnic groups, one-half begin their higher education at community colleges—more than double the rate of peers from high-income families (Coley, 2000). The link between ethnicity and college choice holds true, even after controlling for income. According to an analysis by the National Center for Public Policy in Higher Education (Policy Alert, 2011) using data from the Educational Longitudinal Study (2002 - 2006), students from

underrepresented racial or ethnic groups are more likely to enroll in community colleges as their first postsecondary institution. Nationally, 50% of Hispanic students start at a community college, as well as 31% of African American students, and 28% of White students. These initial enrollment decisions influence pathways through higher education in ways that reproduce social stratification (Grodsky & Jackson, 2009).

Background: Importance of a College Degree and Historical Trends

Deeply embedded in many seminal philosophic works on adult education is the belief that education should be accessible to all adults in order to improve their lives in ways they value. Humanist author and psychologist Abraham Maslow wrote that the ultimate purpose of education is "self-fulfillment, for becoming what one has the potentiality to become" (Maslow, 1954; citation from Merriam & Elias, 2005, p. 121). The progressive tradition expands the focus beyond the individual, highlighting the important social role of education in underpinning a just, democratic society. Dewey writes, "The democracy which proclaims equality of opportunity as its ideal requires an education in which learning and social application, ideas and practice, work and recognition of the meaning of what is done, are united from the beginning and for all" (Dewey, 1915, p. 315). Reflecting on the writings of Dewey, Monk (2008) states, "education becomes intertwined with moral and social goals…education is about providing tools for individuals to grow, live, and contribute to society" (p. 65).

Community colleges have operationalized these ideals and increased access to higher education in the United States since the early 20th century (Anderson, Sun, & Alfonso, 2006). The first study on transfer students by Medsker (1960) confirmed that community colleges could prepare transfer students to succeed at baccalaureate-granting

institutions and helped lead to the expansion of "junior" colleges across the country. While community colleges serve roles beyond promoting transfer and baccalaureate attainment (i.e. adult basic education, workforce training, and continuing education), since their expansion post-World War II, they have focused on providing an accessible, affordable alternative to direct entrance into four-year universities (Anderson et al., 2006). Community colleges are now educating nearly one-half of all students enrolled in post-secondary education (Kirst, 2007). The emphasis on transfer, institutional programming, academic research, and public policy has deepened as the value of, and demand for, baccalaureate degrees has increased.

While college tuition has increased over the last few decades, the economic returns of a baccalaureate degree far outweigh the costs. The average college graduate with a bachelor's degree will earn nearly $1 million more in their lifetime than a peer who enters the workforce with a high school diploma (Carnevale, 2016), and has less than one-half the risk of unemployment (Carnevale, 2015). In addition, there is a significant social return in developing civic skills related to democratic participation (Kisker et al., 2016), and through increased taxes paid by college graduates – between $52,000 to $67,000 more over a lifetime (Klor de Alva & Schneider, 2011). As degrees become increasingly important to economic security and prosperity, there is a critical need to address factors inhibiting individuals from advancing through higher education.

Problem Statement

With tuition costs rising at four-year institutions, the option for community college transfer has received heightened attention from legislators and university administrators seeking to sustain and expand access to undergraduate education. In the

1980s, states accelerated their adoption of articulation policies to align educational institutions and provide greater clarity to two-year colleges and their students regarding the transferability of credits (Roksa, 2009). According to a study by the Education Commission of the States (Smith, 2010), over 30 states have now implemented some form of statewide articulation mandates. Transfer policies pursue the alignment goal through several different means, including: 1) common course numbering which helps to simplify the matching of courses at the community college level with their counterparts at four-year institutions within the state; 2) transferable common core curriculum which ensures students who complete the prescribed series of courses receive block credit for general education coursework at their transfer institution; and, 3) guaranteed transfer for students who complete an associate degree prior to transfer.

Despite the seemingly obvious benefits of these policies, studies have found scant empirical evidence supporting their impact on transfer rates or baccalaureate completion (Anderson et al., 2006; Perkins, 2010; Roksa, 2006; Roksa & Keith, 2008). Using data from the Beginning Postsecondary Students Longitudinal Study of 1984 - 1994, Anderson et al. (2006) found that the rates of transfer in states that have implemented state-mandated articulation policies did not differ substantively from the rates in states that have not. In a similar study using NELS data from 1988 - 2000, Roksa (2006) found no relationship between statewide articulation policy and transfer rates. Roksa and Keith (2008) concluded that "articulation policies do not appear to enhance bachelor's degree attainment in the public sector" (p. 247).

The push toward encouraging completion of lower division coursework at the community college prior to transfer is picking up momentum in state policy,

whether in the form of a state-designated core curriculum or an associate degree. However, there is ample evidence that students who transfer within the first two years do just as well as those who follow the structured transfer pathways included in articulation policy. Research on moving policy discourse in the opposite direction, toward focusing on aligning course selection to a students' intended baccalaureate major irrespective of time spent or degree earned at the community college prior to transfer, is underdeveloped in the literature.

As four-year institutions compete to recruit applicants, transfer students have also increasingly become a focus for their admissions departments. Four-year institutions have developed a variety of resources to assist transfer students in making a seamless move between institutions including dual-enrollment programs and transfer planning guides that recommend coursework at the community college level to align with degree requirements for each baccalaureate degree. Such institution-led programs offer a third potential transfer track for community college students who are making decisions about how to organize their course selection decisions to best prepare for future transfer.

To assess the potential impacts of alternative policy directions, and the effectiveness of institutional programs to support transfer, it would be helpful to better understand how following these suggested transfer tracks will impact a student's likelihood of transferring and completing a baccalaureate degree. This study seeks to better understand whether course selection at the community college prior to transfer impacts the likelihood that a student will persist at the four-year university. The outcomes from the research are intended to inform both

policy decisions related to the degree of weight to give to any one type of pathway in structuring guidance and incentives for universities and their students, and to practitioners who may be advising students on the best pathway to take prior to transfer.

While this study only focused on students who had transferred to a four-year institution, and therefore cannot address the effect on likelihood of transfer, the use of transcript analysis for course enrollments at the community college, paired with enrollment and graduation records at a four-year public research university, enabled the research to address the link between course selection at the community college level and baccalaureate degree completion. Three variables were used to represent the course selection pathways ("pathways") found in policy and the academic literature: 1) whether a student obtains an associate degree prior to transfer; 2) the proportion of recommended course credits completed out of the total number included in the transfer planning guide corresponding to their chosen major; and 3) the number of core credits earned at the community college.

Research Questions

The study addressed a few overarching questions related to policy and institutional framing of course selection options to promote successful transfer pathways. Are transfer planning guides effective at improving the transferability of coursework and student persistence? What are the relative benefits of following a transfer planning guide as compared to a standard core curriculum or associate degree as frameworks for guiding course selection decisions? Does following a structured pathway help increase the

likelihood of persisting to baccalaureate degree completion? The study also explored two related questions hypothesized to mediate any relationship between course selection pathways and persistence: 1) whether the pathways have the intended effect of reducing the proportion of non-transferable credits earned, and, if so, any relationship this may have on persistence; and, 2) whether the amount of time spent at the community college, expressed as total transfer credits completed, moderates the effect of a pathway on persistence. The research questions explored in the study are listed below.

Research Question 1. Does the number of core credits earned at the community college affect the likelihood of persistence at the four-year institution?

Research Question 2. Does earning an associate degree prior to transfer reliably predict the likelihood of persistence at the four-year institution?

Research Question 3. Does the percent of recommended transfer planning guide courses completed at the community college in a student's declared major reliably predict the likelihood of persistence at the four-year institution?

Research Question 4. Does the percent of transfer credits accepted reliably predict persistence at the four-year institution?

Research Question 5. Does the number of credits completed prior to transfer reliably predict the likelihood of persistence at the four-year institution?

Research Question 6. Does the number of credits completed prior to transfer moderate the relationship between any of the three defined course selection pathways and the percent of transfer credits accepted?

Research Question 7. Does the number of credits completed prior to transfer moderate the relationship between any of the three defined course selection pathways and

persistence at the four-year institution?

Research Question 8. Does the percent of transfer credits accepted mediate the relationship between any of the three defined course selection pathways and persistence at the four-year institution?

Research Question 9: Do the outcomes of the research questions posed in this study differ significantly for non-traditional students (25 and older) when compared to those for students 24 years old and under at the time of transfer?

Terms and Definitions

Terminology related to community college transfer and statistical methods used in this study is defined below to provide greater clarity for the reader.

1) Bootstrapping is a nonparametric approach to statistical inference that uses variability within a sample to estimate the sampling distribution, rather than making assumptions about the sampling distribution of the population.
2) Cohort is a term used to describe a group of students who share a common first academic year (AY) of enrollment.
3) Confidence interval is a range of values defined so that there is a specified probability that the values of a parameter lies within it.
4) Core courses refers to a 42-credit hour block of courses designated by the Texas Higher Education Coordinating Board for guaranteed transfer between community colleges and public four-year institutions in the state.
5) Degrees of freedom is defined as the number of observations in the data that are free to vary when estimating statistical parameters.

6) Degree track is used in this study to refer to a set of recommended courses included in a transfer planning guide. A student who takes the recommended courses is referred to as following that degree track.
7) Direct effect measures the change in an endogenous variable when the exogenous variable increases by one unit.
8) Elective credit non-advanced (ELNA) is defined as transfer credit awarded by the four-year institution which may be counted as a general elective credit but for which the university does not offer an exact equivalent course. Such credits do not count toward core coursework nor degree-specific requirements.
9) Endogenous variable is a variable included in a path analysis model which is anticipated to be predicted by other variables in the model; also referred to as an independent variable.
10) Error variance is the portion of the variance in the prediction of the endogenous variable that is due to extraneous variables and measurement error.
11) Exogenous variable is a variable included in a path analysis model which is anticipated to have a predictive relationship to another variable in the model, but whose own variance is not explained by any other variable in the model; also referred to as a dependent variable.
12) Indirect effect measures the transmission of the effect of an exogenous variable on an endogenous variable, mediated through one or more other variables.

13) Interaction term is a variable created to represent the interaction between two exogenous variables. In this study, interaction terms are created to test for moderating relationships between variables.
14) Maximum likelihood estimation is a statistical method for estimating population parameters (such as the mean and variance) from sample data that selects as estimates those parameter values maximizing the probability of obtaining the observed data.
15) Mediator variable is a variable that sits between an exogenous variable and another endogenous variable such that some of the effect of the exogenous variable on the endogenous variable can be explained by the mediator variable.
16) Moderator variable is a variable involved in an interaction between variables in a path model such that the effect of one variable on the other changes depending on the value of the moderator variable.
17) Odds ratio is the odds of one potential outcome (i.e. persistence beyond the second year of enrollment) divided by the odds of the other potential outcome (i.e. discontinued enrollment in the first two years at the four-year institution).
18) Parameter is a measurable characteristic of a population, such as a mean or a standard deviation.
19) Path Analysis is a statistical method of analyzing direct and indirect relationships between variables in order to test the degree to which observed data fits within a theorized causal model. Path models are usually depicted

with a diagram in which arrows drawn between variables are used to specify the anticipated direction of predictive relationships.

20) Persistence is used in this study to refer to continued enrollment beyond the second year after transfer. Also referred to as two-year persistence.

21) Standardized parameter estimate (also known as standardized beta coefficient) reports the effects in units of standardized deviations rather than in terms of the unit of measurement of the variables. Standardized parameter estimates represent the change in standard deviations of the endogenous variable for one standard deviation change of the exogenous variable.

22) Stop out is a term used to describe students who discontinue enrollment for one semester or more.

23) Student classification represents the class level at the time of transfer based on credits completed, with values: Freshman (completed fewer than 30 credit hours prior to transfer), Sophomore (completed 30-59 credit hours prior to transfer), Junior (completed 60-89 credit hours prior to transfer), and Senior (completed 90 or more credit hours).

24) Total effect is the sum of the direct effect plus indirect effect(s).

25) Transfer planning guides are documents created to advise community college students on a recommended set of core coursework and other lower division pre-requisite courses that align with upper division coursework in the selected major. They are posted on community college and four-year university websites and can be provided to students by an academic advisor.

26) Unstandardized parameter estimate represents the amount by which the endogenous variable changes if we change an exogenous variable by one unit, keeping other exogenous variables constant.

27) Variance-covariance matrix refers to the matrix of covariances between the elements of two vectors. It consists of the variances of the variables along the main diagonal and the covariances between each pair of variables in the other matrix positions.

II. LITERATURE REVIEW

The purpose of this literature review is to provide a synthesis of publications on the underlying causes for low transfer rates and the development of policy and programs to improve degree attainment for community college students, including: the challenges community college students face; statewide policy mandating articulation of coursework between two-year and four-year public institutions; the effect of time enrolled at the community college level on baccalaureate degree attainment; and the literature on the common dip in grades in the first year after transfer to a four-year institution.

Theory of Student Persistence

This study is based on the theoretical framework provided by research on student persistence to graduation. The seminal work of Vincent Tinto (1975, 1987) has been the most influential and enduring theory used to explain why students choose to discontinue their studies before graduating. The Student Integration Model (SIM) developed by Tinto was influenced by the work of Durkheim's theory of suicide, which posited that the existence of a social support network has a predictive relationship to the likelihood that an individual will take their own life. Similarly, the SIM model drew a connection between a student's level of academic and social engagement with an institution and their likelihood of persisting to graduation.

In the model, student attributes such as family background, individual characteristics and pre-college schooling are expected to have a predictive relationship to students' level of commitment to the graduation goal as well as the institution where they are enrolled. Goal commitment in turn is associated with academic integration and grade performance, and institutional commitment is linked to social integration with a peer-

group and faculty at the institution. These relationships generate a feedback loop that either acts to strengthen or weaken student commitment, ultimately influencing the decision whether to continue enrollment.

The SIM model has been tested and validated through numerous empirical studies over the past 40 years (Bean, 1980, 1982, 1985; Pascarella & Terenzini, 1979, 1980). However, studies have found that the postulated relationships between goal and institutional commitments and academic and social integration have not been consistently supported when accounting for variations in gender, ethnicity, and the type of institution (Cabrera, Stampen, & Hansen, 1990). Indeed, the SIM model has been critiqued for not accounting for factors external to the institution on student decisions or the experiences of non-traditional and community college students (Bean, 1985).

In part to address these limitations, Bean developed an alternate model, the Student Attrition Model (SAM), to explain student persistence (Bean, 1980, 1982, 1983, 1985). The SAM model contrasts with the SIM model by emphasizing the relationship between attitudes and behaviors associated with attrition and environmental factors such as family support. The two models were later combined into an Integrated Model of Student Retention by Cabrera, Nora, and Castaneda (1993), who found that there was significant overlap among many of the variables related to institutional commitment and that the combined model had greater predictive validity.

While many of the attitudinal variables used in these models are derived from student surveys, researchers have more recently begun to use transcript analysis to develop variables which can measure a student's follow-through with stated goals. Hagedorn (2008) argues that the ratio of courses completed to courses enrolled, the

course completion ratio (CCR), can be used as an indicator for predicting community college student persistence.

Financial Aid and Scholarship Assistance

Economic considerations drive college selection for a majority of community college students. Using data from the 2011–12 National Postsecondary Student Aid Study (NPSAS:12), Radwin, Wine, Siegel, and Bryan (2013) found that 68% of community college students chose their college based on cost. One in three community college students in their study had family incomes of less than $20,000, and 69% of community college students worked while in college, with 33% having worked 35 or more hours per week. Community college students are nearly twice as likely to work full-time while attending school as students attending four-year universities (Orozco, & Cauthen, 2009).

The link between socioeconomic status and the need to work while in school has implications for educational attainment. Heavy work schedules leave less time for studying, and, inasmuch as a student's ability to maintain full-time enrollment is affected, work schedules can significantly impact academic progress. Research has shown that working more than 20 hours per week negatively impacts student persistence and academic success (Advisory Committee on Student Financial Assistance, 2008; as cited in Handel, 2012). Responsibilities outside the classroom may also contribute to students' withdrawal from courses prior to completion.

It is not surprising then that full-time enrollment has been found to improve transfer rates and degree outcomes (Doyle, 2009; Tuttle & Musoba, 2013). Students who enroll full-time are significantly more likely to attain a bachelor's degree within six years

(80%), compared to students who switched between full- and part-time (55%), and students who enrolled exclusively part-time (25%) (Shapiro, Dundar, Ziskin, Chiang, Chen, Harrell, & Torres, 2013). According to an analysis by the American Association of Community Colleges (AACC) using 2014 data from the National Center for Education Statistics Fall 2013 Enrollment Survey, approximately 60% of community college students were enrolled part-time, as compared to approximately 40% at four-year institutions (Juszkiewicz, 2014).

Research indicates that students who receive financial assistance in community college have better outcomes (Geckeler, Carrie, Michael, & Leo, 2008). Scholarships of as little as $1,000 can encourage full-time enrollment and impact student retention in community colleges (Brock & Richburg-Hayes, 2006; Patel & Richburg-Hayes, 2011). Despite the potential benefits of accessing financial aid to support full-time enrollment, only a little over half of community college students receive any form of financial aid (Juszkiewicz, 2014). This may be due in part to a lack of information or the perception that the low cost of community college is better covered through work in place of loans. The differential in student aid received drops off once community college students enroll in four-year institutions (Monaghan & Attewell, 2015). Counterintuitively, the out-of-pocket price without financial aid is sometimes greater at community colleges than at four-year institutions (Juszkiewicz, 2014).

There are also many structural barriers that limit access to financial assistance for part-time students, including credit hour minimums in order to qualify for certain types of aid (Chao et al., 2007). Additionally, many policies targeted at incentivizing transfer provide the extra financial assistance only to students who successfully transfer

(Bowling, Morrissey, & Fouts, 2014). This effectively rewards students who would already be the most likely to receive other forms of financial aid while doing nothing to change the core challenges faced by students who take on heavy workloads in lieu of financial aid in community colleges. Modifying financial incentives to make funds available from the first semester of enrollment and building in rewards for achievement of milestones along the transfer pathway may help improve baccalaureate degree completion (Wellman, 2002).

Complexity in the Transfer Pipeline

The daunting degree of complexity students face in successfully navigating the transfer process is one commonly cited barrier to improving transfer rates (Goldin & Katz, 2008; Handel, 2013). Many community colleges allow students to choose from an abundance of disconnected courses and programs. A lack of structured guidance impacts students' ability to make informed decisions and contributes to the low program completion rates (Bailey, Jaggars, & Jenkins, 2015). Although research has shown that entering a program of study within the first year, defined as three courses toward a degree program, significantly enhances students' transfer and degree completion rates, only half of community college students meet this milestone (Jenkins & Cho, 2012).

The flexibility offered to students in course selection may particularly disadvantage low-income and first-generation students who are least likely to have the college knowledge required to make informed decisions associated with pursuing their educational goals (Deil-Amein & Rosenbaum, 2003; Scott-Clayton, 2011). Person, Rosenbaum, and Deil-Amein (2006) drew on Bourdieu's (1977) concept of *cultural capital* to suggest that (mis)information plays a significant role in the difficulties many

community college students face. They write, “our survey data show that parent education and income are significantly correlated with students’ reported information about college requirements” (p. 382). They continue that students reported, “using meager, vague, and even incorrect information as the basis for their educational choices, such as where to enroll, and what field to study… taking the wrong classes or misunderstanding the value of remedial coursework” (p. 384). The authors suggest that lacking the structure and support resources offered by many four-year universities, first-generation community college students are more likely to obtain non-transferable credits that extend time to transfer and increase costs, both factors that may become influential in decisions to discontinue studies or change degree aspirations.

Even for students who have determined their major and target four-year institution, selecting the right courses is dependent upon understanding the specifics of articulation agreements and program-specific transfer requirements. Any change in major, common for many undergraduates, could affect the transferability of completed coursework and cause a delay in transfer plans. Structural and scheduling barriers may also play a role in limiting a student’s ability to efficiently pursue an educational path inasmuch as students are unable to enroll in required coursework due to the timing and availability of course offerings (Scott-Clayton, 2011; Zeidenberg, 2015). Remedial coursework requirements, affecting approximately 60% of community college students, do not count as transferable credits and have been shown to be negatively correlated with baccalaureate graduation rates (Adelman, 1999, 2006; Bailey & Alfonso, 2005; Calcagano et al, 2006; Crook et al, 2014; Gao, 2002; Goldrick-Rabb, 2010; Jones & Lee, 1992).

Transferability of Credits

Research is mixed on the relationship between credit accumulation prior to transfer and student outcomes. McCormick and Carroll (1997) found that higher levels of transferable credits earned are associated with higher baccalaureate graduation rates. However, research has also found a negative relationship between non-transferable credits earned and persistence rates.

Doyle (2009) explored the influence of transferable credits accepted by four-year institutions and found a significant difference between the graduation rates for students who had all credits accepted from those who had accumulated non-transferable credits at the time of transfer. Among students with all credits accepted, 82% completed a baccalaureate degree within six years, whereas only 42% of students with only some of their credits accepted completed a degree. This finding has been corroborated in a more recent study by Monaghan and Attewell (2015), who also found a negative effect of accumulating non-transferable credits on the baccalaureate degree completion rate of transfer students. In their study, students who had at least 90% of credits accepted were 2.5 times more likely to graduate with a baccalaureate degree than those with less than half of their credits transferred.

Policy Focus: Earning the Associates Degree Prior to Transfer

Several researchers and policy advocates have argued that encouraging attainment of an associate degree prior to transfer should be a direction for improving the effectiveness of statewide policy to promote transfer (Couturier & Jobs for the Future, 2012; Handel, 2012; Hezel Associates, 2010; Hodara & Rodriguez, 2013). Yet, there is little empirical support for the relationship between associate degree attainment and

baccalaureate completion.

As support for their recommendation to promote associate degree attainment as a policy objective for strengthening transfer student outcomes, Couturier & Jobs for the Future (2012) cite a report by the National Student Clearinghouse Research Center (2012). While the report does show a higher rate of baccalaureate completion for students who obtain an associate degree prior to transfer, the study relies on descriptive analysis and does not attempt to isolate the influence of the associate degree from other potentially conflating factors such as the number of credits completed prior to transfer. Similarly, in a 2006 study, Townsend and Wilson write:

> Knowing that two-year college students who transfer with an associate of arts degree are the most likely to complete the baccalaureate degree and in the shortest time (e.g., Carlan & Byxbe, 2000; Glass & Harrington, 2002) is useful information for community college advisors and four-year college admissions directors and advisors. (p. 441)

However, the two cited studies do not in fact support the conclusion that there is a relationship between the associate degree and baccalaureate completion. Both studies focus on predictors of student GPA, and the latter uses a sample of only 50 transfer students. Carlan & Bixby (2000) reach the opposite conclusion from the one they are associated with supporting. Finding that associate degree attainment is not a significant predictor of academic performance, they suggest, "efforts to require earning the A.A. degree seem void of merit" (p. 38).

Despite the lack of supporting empirical evidence, some higher education systems have begun experimenting with aligning associate degree programs with articulation agreements to guarantee junior status post-transfer. The City University of New York (CUNY) System developed an articulation policy stipulating that students who graduate with an associate degree from a CUNY community college are guaranteed admission to

one of the CUNY senior colleges and transferability of credits sufficient to place them at a junior class level (Roksa, 2009). Since 2011, California, Florida, and Oregon have enacted similar legislation (Anderson, ECS, 2014).

Each semester at the community college level has a lower cost of tuition, and therefor pursuing the associate degree prior to transfer is often framed in economic terms. Students are assumed to benefit from lower tuition costs and higher earning potential once the degree is obtained. However, the additional time required to pursue the associate degree path to four-year transfer can imply greater overall opportunity costs in the form of lost years of work at higher post-baccalaureate wages, and an increased risk of stopping out at the community college level beyond the second year (Managhan & Attewell, 2015).

The call for aligning incentives and advising around achieving an associate degree prior to transfer also ignores the reality that most students who transfer do so prior to earning an associate degree. In a longitudinal study of students who transferred to a four-year institution in 2005-2006, 64% had not earned an associate degree (Shapiro et al., 2013). This is consistent with findings from earlier studies. In a study including students in 13 states, Palmer, Ludwig, and Stapleton (1994) discovered that just 37% of students completed their associate degree prior to transfer. Another study using data on students in Oregon between 1995-2001 found that, on average, just 30% of community college transfers to the Oregon University System had earned an associate of arts degree (Arnold, 2003). Similar findings led lgnash and Townsend (2001) to suggest that statewide agreements acknowledge actual student behavior and focus on transferable blocks of coursework to be completed prior to an associate degree:

> Tying transfer to completion of the associate degree … may be unrealistic, given that many community college students transfer to another institution … before they complete the A.A. degree (Cohen & Brawer, 1996) … statewide articulation agreements [should] facilitate student transfer with an agreed-upon general education core and at other appropriate points before completion of the associate degree. (p. 189, as cited in Arnold, 2003)

Policy Focus: Transferable Core Curriculum

The number of credits required by statewide policy for satisfaction of the core curriculum at the community college level appears to be a potentially significant factor on student outcomes. Hodara and Rodriguez (2013) studied the impact of core coursework completion at colleges in two states, one with a 42-credit core ("College A") and another with a 36-credit core ("College B"). They found that completion of the full block of core courses had a substantial effect on baccalaureate degree attainment. At College A, only 8% of students who accumulated 30-41 credits earned a degree, compared with 54% for those completing all 42 credits. A similar effect was found for College B (17% versus 70%). The significance of completion is alarming given the low rates of students completing the full block (29% at College B and 12% at College A).

Surprisingly, the authors do not address the apparently striking impact of the decision as to where to set the completion point. What conclusion should be drawn from the fact that students at College B who complete the prescribed 36 credits see a 53% jump in degree attainment, but students at College A who complete the same number of units remain substantially less likely to complete a degree until they finish an additional 8 more credits? The authors argue that "to boost degree completion rates, College A should consider implementing practices that encourage core completers, who have already accumulated at least 42 credits toward an associate degree, to earn an associate degree before transferring" (p. 3). The authors do not discuss possible options for

moving in the opposite direction and finding ways to lower the policy milestones related to transfer.

Hodara and Rodriguez (2013) identified another concerning pattern in their research; non-completers were most likely to avoid taking the math course and science subject area requirements, and instead accumulate excess core credits in the social and behavioral sciences, which are not guaranteed to transfer. This highlights the possibility that students may, understandably, gravitate toward courses they find interesting and avoid courses they find difficult or uninteresting. Across the literature on community college transfer, there is a consistent theme that student academic achievement and motivation improves as connections are made between coursework and career goals. Yet policy promoting core completion as a transfer pathway encourages students to put general education courses ahead of pursuing their interests and may promote disengagement.

It also raises another important critique of current articulation policy and the significance given to fully completing the core curriculum at the community college. In many states, the benefit of full transferability of credits in satisfaction of general education requirements is only guaranteed if students complete the full block of core credits. The number of credits required to meet this requirement varies from 30 credits in New York, to 42 credits in Texas, to 60 credits in Georgia (Arnold, 2003). The same study shows that in most states, if a student does not complete the full core curriculum at the community college, credits are considered toward core completion only inasmuch as they align with individual core courses required at the transfer institution, which likely contributes to credit loss. Despite the efforts of states to address the transferability of

credits between two-year and four-year institutions, recent research demonstrates that only 58% of transfer students receive credit for all or most of the coursework completed at the community college level (Monaghan & Attewell, 2015).

Reconsidering Transfer Timing

There is evidence to suggest that statewide policy should be considering how to enable transfer as early as possible. In a study using data from the 2004-2009 Beginning Post-Secondary Students (BPS) survey, Managhan and Attewell (2015) found that within the first two years, students who began at community colleges were similar to those who began at non-selective four-year institutions in terms of credits earned, attendance, and credits earned as a percentage of all attempted. However, after the second year, measures of academic accomplishment declined significantly for community college students as compared to the four-year group. This divergence in outcomes included a 10% higher stop out rate for community college students.

According to the study, the average community college student does not attain 60 credits (the average required for an associate degree) until sometime in the beginning of the fourth year. Even among students who express an intent to transfer and who do successfully complete an associate degree, only two-thirds actually transfer to a four-year college. The authors note that, "the BA attainment rate for those who transfer after earning a few credits is not statistically significantly different from that of students who completed 60 or more credits at their initial college" (p. 82). If earning an associate degree prior to transfer does not significantly enhance student baccalaureate degree achievement, it raises the question as to whether it should be treated as an important milestone prior to transfer.

A growing body of research on the transition to four-year institutions further supports the idea that students may benefit from earlier transfer. Recent evidence suggests that any gap in outcomes related to the number of credits obtained prior to transfer may be small or may work in the opposite way assumed by proponents of delaying transfer. In a longitudinal study by Ishitani (2008), students entering as sophomores with 30-60 credits had higher retention rates at each semester as compared to students entering as juniors.

Research by the National Student Clearinghouse on the timing of transfer indicates that transfer and mobility in later years of students' enrollment may potentially add years to their time to degree (2012). Transfer has also been shown to have positive effects on factors associated with retention according to Tinto (1975). Berger and Malaney (2003) found that overall student satisfaction increased after transferring from a community college to a four-year institution. This was associated with other changes post-transfer that Tinto's Student Integration Model found to be significantly associated with persistence to graduation, including increased socializing with fellow students and a decrease in the amount of time spent on outside commitments such as work and family to accommodate a greater demand for study time.

Making the Transfer Transition

Making a successful adjustment from community college to the four-year university is a critical milestone in the persistence of transfer students. Many transfer students struggle with making the academic transition. In fact, GPA, both prior to transfer and at the four-year university level, is one of the strongest predictors of baccalaureate completion (Crook et al, 2014; Bailey & Weininger, 2002; Crook & Lavin,

1989; Wang, 2009; Tuttle & Musoba, 2013). Hills (1965) was the first to use the term *transfer shock* to report evidence of a common dip in GPA in the first-year post-transfer. Studies have consistently found that a decrease of 0.5 grade points or more in the first semester have a strong negative correlation with persistence (Glass, 2002; Ishitani, 2008). However, students who make it beyond this initial transition period have equivalent overall academic performance and graduation rates as students who begin at a four-year institution (Carlan & Byxbe, 2000; Glass & Harrington, 2002; Koker & Hendel, 2003).

Student characteristics such as ethnicity and age may significantly affect transfer students' integration into the campus community (Wawrzynski & Sedlacek, 2003) and impact graduation rates. The role of ethnicity in persistence has been inconsistent across studies; "Whiteness" has been both positively correlated with persistence (Koker & Hendel, 2003) and negatively correlated (Tuttle & Musoba, 2013). The relationship between age and persistence is clearer. The literature on transfer has found that age at the time of first enrollment has a consistent and significant effect on attitudes toward transfer and education, and on persistence rates (Calcagano et al, 2006; Goldrick-Rabb, 2010; Honnold & Scott, 1989; Ishitani, 2008; Tuttle & Musoba, 2013). On average, traditional age students (under 25) persist to baccalaureate graduation at higher rates as compared to students older than 24 (Ishitani, 2008; Tuttle & Musoba, 2013).

Summary

With an ever-increasing demand for a college degree, community colleges continue to be an essential component in the higher education system. They remain a financially feasible option for many students who may not have the interest in or capacity to take out sufficient financial aid for a four-year institution. Adjustments to align degree

pathways between higher education institutions through mandated articulation around a core curriculum and associate degree may help advisors and the students they work with to clarify the transferability of credits. However, additional time spent pursuing these pathways may lengthen the time to graduation and increase the risk of stopping out, especially when associated with part-time enrollment.

III. METHODS

Many of the elements included in the foundational theories of student persistence discussed at the beginning of the previous chapter, as well as the more contemporary research on challenges unique to transfer students, are integrated into the methodology developed for this study. These include the proposed role of student characteristics such as age and ethnicity and the influence of course selection patterns on persistence post-transfer. This study was designed to test a theory for how these variables are related to each other and to student persistence. This section contains a discussion of the methods used in the study, including: 1) research design, 2) population and sample, 3) data collection procedures, 4) data screening, and 5) data analysis.

Research Design

The primary objective of the study design was to evaluate the underlying theory of change for promoting better transfer outcomes through course pathways. That is, the assumption that transfer credit loss impacts graduation rates, that it can be mitigated by establishing structured articulation pathways, and that students who follow these pathways when selecting coursework prior to transfer will have higher credit transfer and baccalaureate graduation rates. A secondary objective was to evaluate the relative benefits of the two primary pathways currently prevalent in policy discussions, completing core coursework and earning an associate degree prior to transfer, as compared to an alternative offered by following major-specific coursework as outlined in transfer planning guides.

Quantitative methods were selected due to the nature of the research questions; namely, whether there is a relationship between quantifiable variables related to pre-

transfer courses, proportion of credits accepted by the four-year institution, and persistence. The initial intent of the study was to develop and test a path analysis model using an ex post facto design. Path analysis was selected as the statistical method to use due to the advantages it offers for testing a conceptual model predicting the interrelationships between variables, including direct and indirect effects (Mertler & Vannatta, 2010). A conceptual model was developed based on the literature reviewed herein, including variables demonstrated in the literature to be predictive of course transferability or persistence.

Population and Sample

The sample selected for the study included transfer students from two of the largest feeder institutions to Texas State University (Texas State), Alamo Community College (Alamo) system in San Antonio and Austin Community College (ACC) in Austin. As shown in Table 1, the total sample population of students transferring from these two institutions across the four cohort years is approximately 2,000, after applying controls on the sample to improve the generalizability of the results.

Table 1

Distribution of Transfer Students by Institution and Year of First Enrollment

Institution	2012	2013	2014	2015	Total
ACC	365	349	364	362	1,440
Alamo	126	145	136	159	566
Total	491	494	500	521	2,006

Source. Texas State University Office of Institutional Research

The pathways community college students take to transfer are diverse in many ways, lending to a large degree of complexity and variability in the definition of transfer

student. Enrollment records from the National Student Clearinghouse were used to limit the sample to students for which Alamo or ACC are the only institutions attended outside of Texas State. The restriction to these two community college systems serves to control for variances pertaining to student advising practices, course offerings, the availability of Texas State transfer planning guides, and the applicability of Texas transfer policy. Students with only one term at the community college or who did not transfer within 15 terms were removed from the dataset. The decision to remove students who do not complete the equivalent of one full-time semester of coursework at the community college and to use a time restraint in sampling is consistent with previous research on transfer (Roksa & Calcagno, 2010).

Data Collection Procedures

The sample data set from institutional records was requested from the Texas State University Office of Institutional Research. Institutional Research was asked to anonymize all records using a randomly generated unique identifier prior to providing access to the information. The data included both student-level variables as well as individual course-level data for each semester taken at the community college level and at Texas State. Both transferable and non-transferable courses were requested. Transfer records came from the Texas State student records system. All records are entered by Admissions staff during the application process. Student-level profile information is self-reported through the common application system used throughout the state. Staff from the Admissions office and Institutional Research was asked to comment on any concerns with data validity for the requested information.

Additionally, the Office of Institutional Research obtained enrollment and

graduation records dating back to 2001 from the National Student Clearinghouse to verify enrollment dates, enrollment status, graduation dates and degrees earned. More than 3,600 colleges and universities report enrollment and graduation data to the Clearinghouse, constituting over 98% of all students in public and private institutions in the United State (National Student Clearinghouse, 2018).

Birthdates and National Student Clearinghouse data were combined to create a variable for age at the time of transfer to Texas State. Age group was then coded as a dichotomous variable based on age at the time of the first enrollment at Texas State, with values traditional (under 25) and non-traditional (25 and older). This new variable was used to separate the sample for comparative analysis of the impact of age at the time of transfer on relationships between other study variables. Table 2 contains the sample size by age group and year of first enrollment at Texas State.

Table 2

Distribution of Transfer Students by Age and Year of First Enrollment

Age Group	2012	2013	2014	2015	Total
Traditional	321	343	354	392	1,410
Non-Traditional	170	151	146	129	596
Total	491	494	500	521	2,006

Source. Texas State University Office of Institutional Research

Data Screening

Prior to analysis, the sample was screened for missing data through frequency tables for all variables. Scatterplot matrices were used to test for the assumption of homoscedasticity for each of the key variables. Box plot graphs, quintile-quintile plots, and distributional histograms were used to check for outliers, univariate normality,

skewness, and kurtosis. Additionally, STATA was used to run skewness and kurtosis tests for univariate and multivariate normality.

Skewness in the distribution of some variables was expected due to factors inherent to the variables. For example, for the variable created to represent the percent of credits accepted, observed values were found to be clustered at the upper range around 90-100% acceptance. Whereas many statistical procedures would need to adjust for this through bootstrapping or other methods, the statistical tests selected, binary logistic regression and Spearman's rank correlation, do not require assumptions of normality in the distribution of study variables.

Kruskal-Wallis H test was used to determine if there were statistically significant differences in persistence outcomes between students based on age group, transfer institution, class level at the time of transfer, gender, ethnicity, or cohort. Kruskal-Wallis H test was selected due to the categorical nature of the dependent variable, persistence. This statistical technique also has the advantage of being a rank-based nonparametric test, and therefor unaffected by nonnormality in the sample data. Multiple group analysis was used for two variables, age group and class level at time of transfer, which demonstrated significant group differences on the parameter estimates.

Data Analysis

Analysis began with coding transcript records to create variables for core coursework taken, transfer planning guide completion, course completion ratio, GPA variance in the first semester post-transfer, the percent of transfer credits accepted, and the outcome variable for persistence. Documentation for transfer planning guides and core coursework was obtained from the Texas State University website and was used to

code transcript records separately for ACC and Alamo where applicable. Students with a declared major for which a transfer planning guide is not published by Texas State or whose transfer planning guide included less than five recommended courses were removed from the sample. The latter decision was made to ensure the variable for percent completion of a transfer planning guide was not overly skewed by students who only needed to take two or three courses in order to complete a majority of the degree track. The final sample included students pursuing 62 different majors across all academic colleges at Texas State. Quantitative variables were left as continuous in the model but were transformed as ordinal variables for discussion and reporting purposes. Where possible, the values for each variable to be transformed were aligned with those used in other quantitative studies on community college transfer.

The endogenous variables in the study include a dichotomous variable, persistence, and a ratio variable, percent of transfer credits accepted. Persistence is treated as a dichotomous variable where persisting is defined as having graduated with a baccalaureate degree or continued enrollment at Texas State as of the 12th class day two-years following the first semester of enrollment. The use of National Student Clearinghouse data in the study enabled tracking students who transferred to another institution after attending Texas State. If a student was found to have left Texas State but still be enrolled at another institution as of fall 2017, they were coded as persisting. Percent of credits accepted is a ratio variable defined as the percentage of credits accepted by Texas State divided by the total credits submitted, excluding developmental, vocational, failed and repeated courses. Percent of credits accepted (% Credits Accepted) was also used to create an ordinal variable with values: <85%; 85-94.9%; and >95%.

Definitions for exogenous variables used in the model are included in Table 3, along with corresponding transformed values for ordinal variables created for each.

Table 3

Exogenous Variables Used in the Path Model

Exogenous Variable	Description	Transformed Values
Ethnicity	Ethnicity is self-reported on the Apply Texas application. Other is made up of the Apply Texas values Hawaiian/Pacific Islander, Multi-race, American Indian/Alaskan Native, Non-Resident International, and Unknown.	White; Hispanic; Black; Asian; Other
Age Group (Age_Group)	A dichotomous variable based on age at the time of the first semester of matriculation at Texas State.	Traditional (under 25); Non-traditional (25 and over)
Course Completion Ratio (CCR)	Defined as the number of courses with a grade of A, B, C, or P divided by the total number of courses of enrollment from community college transcript.	Under 85%; 85%-99%; 100%
Transfer GPA (CC_GPA)	Continuous variable with values between 0 and 4 representing the overall GPA for transferred college coursework at the time of admission to Texas State.	Under 2.5; 2.5-2.99; 3.0-3.49; 3.5-4.0
GPA Variance (GPA_Var)	Continuous variable calculated as the variance between GPA at the time of transfer and GPA at Texas State at the end of the first semester of enrollment.	-.5+ (Transfer Shock); -.49-0; .01 - .49; .5+
1st Term Hours (T1_Hrs)	Continuous variable calculated from transcripts as the number of credits taken during the first term at Texas State.	Part time (1-11 credit hours); Full time (12 or more credit hours)
Passing Hours Submitted (Submitted_Hrs)	Continuous variable representing the number of hours completed with a passing grade prior to transfer.	30-45, 46-60, 61-75, 76-90, 91-105, 106-120, >120

(Continued)

Table 3 (Continued)

Exogenous Variable	Description	Transformed Values
Lost Hours (Lost_Hrs)	Continuous variable representing the number of credit hours which are not accepted for credit by the four-year institution at the time of transfer.	
ELNA Hours (ELNA_Hrs)	Continuous variable representing ELNA credits which are counted as general electives by the four-year institution, but do not count toward core coursework nor degree-specific requirements.	
Associate Degree (AA_YN)	Dichotomous variable indicating whether an associate degree had been awarded to a student prior to transfer.	No = 0; Yes = 1
Classification (ClassT1)	Categorical variable representing the classification given to a transfer student in the first semester at Texas State based on the number of credited hours earned prior to transfer.	Freshman (Under 30 hours); Sophomore (30-59 hours); Junior (60-89 hours); Senior (90 or more hours)
Degree Track Percent (DT_Pct)	Defined as the percent of the courses completed from the transfer planning guide corresponding to the declared major at the time of transfer.	0%; 1-25%; 26-50%; 51-75%; 76-100%
Core Credits (Core_Hrs)	Defined as the number of credit hours completed with a grade of A, B, C, or D for coursework listed on the Texas General Education Core Curriculum.	0-19; 20-29; 30-41; 42 or more
Core Complete (Core_YN)	Binomial variable designating whether a student completed the full 42 credit hours of state-designated core coursework.	No = 0; Yes = 1

The initial study was designed to explore the relationships between the variables using a path model developed in STATA version 14. Exogenous variables selected for

the model were tested for multicollinearity by examining values for the variance inflation factor (VIF) for each exogenous variable, with a VIF greater than 10 treated as an indicator of a problematic linear relationship between a given exogenous variable and the remaining exogenous variables (Stevens, 2001, as cited in Mertler & Vannatta, 2010). Multicollinearity signifies that two or more variables are highly correlated, sharing much of the same information and therefore can be assumed to measure the same thing. Multicollinearity is problematic in path analysis because it violates the assumption of modularity, that is, that the causal processes in the model consist of components which can be isolated and evaluated for their effects on the endogenous variable(s) as separate entities (Knight & Winship, 2013). When present in a model, multicollinearity has the effect of limiting the size of the correlation coefficients and increasing their variances, resulting in a less stable prediction equation (Stevens, 2001).

Total hours submitted for transfer was also hypothesized to moderate the relationship between course selection pathway, percent of credits accepted, and persistence. A moderator is a variable that influences the interaction between two variables such that the value of the effect of the involved variables depends on the value of the moderator variable. For the continuous variables for degree track and core coursework pathways, moderation was tested by including a two-way interaction between course selection pathway and credits submitted as a variable predicting percent of credits accepted and persistence (Tabachnick & Fidell, 2013). Bootstrapping was planned in anticipation of nonnormality in the data (Preacher & Hayes, 2004). Prior to analysis, exogenous variables were standardized to avoid problems of multicollinearity (Aiken & West, 1991). A significant value $p < .05$ for the interaction variable indicates that the

null hypothesis can be rejected, signifying that total hours submitted moderates the interaction between course selection pathway and percent of credits accepted. The path model used to test for moderation is included in Figure 1.

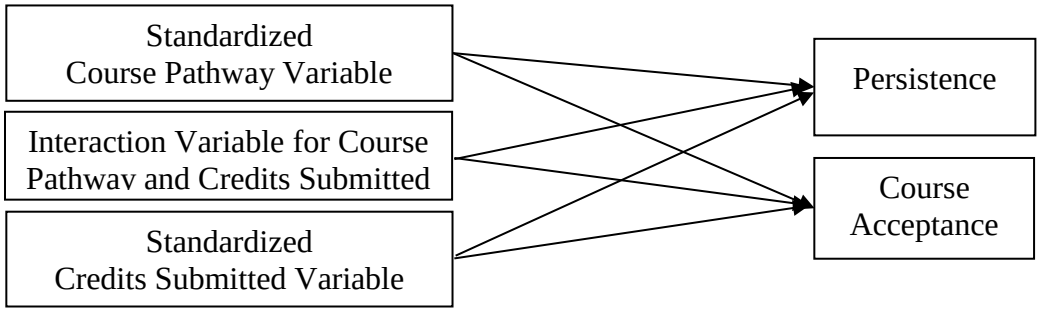

Figure 1. Moderation Model for Credits Submitted and Course Pathway

A different approach was used to test for moderation between the dichotomous variable for associate degree earned prior to transfer and the continuous variable for hours submitted. A series of two-tailed t-tests was used to test for differences in mean rates of course acceptance and persistence between students who earned an associate degree and those who did not at each level of the ordinal variable for credits submitted.

In addition to the direct relationship between course selection pathways (core credits, associate degree, and degree track percentage) and the endogenous variable for persistence, a path model was designed to test for indirect effects mediated through the percent of credits accepted. Baron and Kenny (1986) define a variable as a mediator "to the extent that it accounts for the relation between the predictor and the criterion" (p. 1176). The test for mediation was designed to follow four steps detailed by Kenny, Kashy, and Bolger (1998): 1) establishing a relationship between each course selection pathway and persistence; 2) verifying that an effect exists between the course selection pathway and the percent of credits transferred; 3) testing the relationship between percent

of credits transferred when the course selection pathway is held constant; and, 4) lastly, estimating the path between each course selection variable and persistence, with percent of credits acting as a mediator. The first two steps were tested as part of the analysis for mediation with the model in Figure 1, with the plan to develop a mediation model to test for steps three and four if conditions in steps one and two were satisfied.

A simplified model for the relationship between the mediation variable (M) and the exogenous variable (X) and endogenous variable (Y) is illustrated in Figure 2.

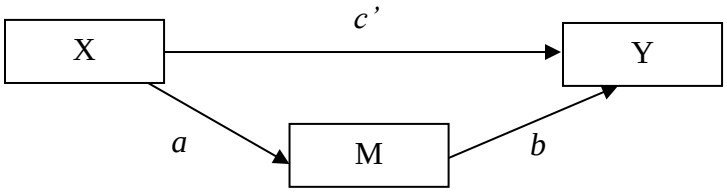

Figure 2. Simple Mediation Model

In this study, the hypothesized path model was intended to test whether the course selection decisions students make in community college (X_i) impact their baccalaureate persistence rates (direct effect on Y). Any effects are posited to be due in part to an increase in the transferability of their coursework to the four-year institution (indirect effects through M). If mediation occurs, the path between course selection pathway and persistence would be smaller when the percent of credits transferred variable is included in the model than when it is left out (Prado, Korelo, & Silva, 2014). A simplified version of the hypothesized mediation model can be illustrated as in Figure 3.

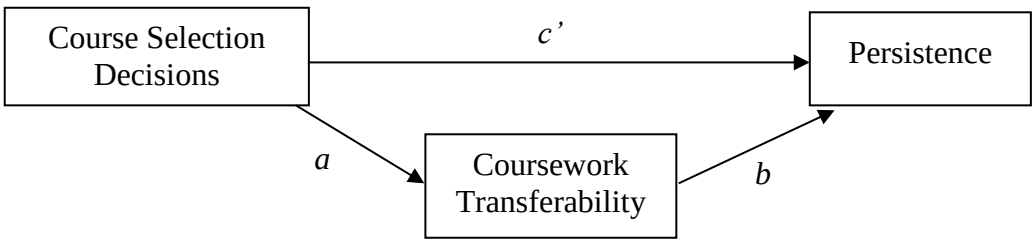

Figure 3. Hypothesized Model for Coursework Transferability as Mediator

The questions of the study are based on a mediation model, which decomposes the total effect of *X* on *Y (c)*, into two parts: the indirect effect of *X* on *Y*, quantified by *ab* (the product of *a* and *b*); and, the direct effect of *X* on *Y* with the effect of the mediator removed, quantified by *c′*; where total effect of X on Y (*c) = ab + c′*. The decomposition of the total effect is quantified by the follow equations for mediation (1), direct effect (2), and indirect effect (3) in general form.

$$M = aX + e \quad (1)$$
$$Y = cX + e \quad (2)$$
$$Y = c'X + bM + e \quad (3)$$

Based on these conceptual variables, the path analysis equations may be generated by the following equations.

$$M = a_1x_1 + a_2x_2 + a_3x_3 + e \quad (4)$$
$$Y = c_1x_1 + c_2x_2 + c_3x_3 + c_4x_4 + e \quad (5)$$
$$Y = c'_1x_1 + c'_2x_2 + c'_3x_3 + b\,(a_1x_1 + a_2x_2 + a_3x_3) + e \quad (6)$$

In a mediation model, the existence of direct and indirect effects is not sufficient to prove mediation. While indirect effects may exist where additional variables influence the relationship between an endogenous and exogenous variable, mediation refers to a causal hypothesis in which changes in X causes changes in M, which in turn causes changes in Y (Little, 2013). Establishing causal inference in mediation entails satisfying logical requirements that relate to study design. One key assumption is that of temporal precedence, or the requirement that the exogenous variable is measured prior to the mediator variable, and that both occur prior to measurement of the endogenous variable. The assumption of temporal precedence is satisfied in the present study. Course selection decisions are measured during enrollment at the community college, the course transferability decision occurs during admission to the four-year university, and persistence is a measure of continued enrollment at the four-year university.

Finally, total hours submitted was hypothesized to contribute to moderated mediation between the course selection pathways, percent of credits accepted, and persistence. Moderated mediation is defined as the interaction between a moderator variable and a mediator variable such that the value of the indirect effect changes depending on the value of the moderator variable. This is known as a conditional indirect effect. Hayes (2013) and Preacher, Rucker and Hayes (2007) provide the theoretical background and framework for moderated mediation.

Conditional indirect effects can be calculated by multiplying coefficients from the model along with selected values of the moderator variable. The study design included the plan to compute conditional indirect effects for four different values of the moderator variable, where total hours submitted = m1; mean(m1) – 1 standard deviation(m1) {Freshman}, mean(m1) {Sophomore}, mean(m1) + 1 standard deviation(m1) {Junior}, mean(m1) – 1 standard deviation(m1) {Senior}. The nlcom command in STATA enables assessment of the conditional indirect effects and their standard errors.

Comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean squared residual (SRMSR) were identified to test for fit of the path model to the data. CFI and TLI values close to 1 indicate a good fit, with values above 0.90 indicating an acceptable fit to the data (Bentler, 1990). The standard interpretation for RMSEA is that the fit is close if the lower bound of the 90% confidence interval (CI) is below 0.05 while a value as high as 0.08 is considered a reasonable error of approximation (Browne & Cudeck, 1993). SRMSR evaluates how well the proposed model reproduces the observed data, with a value below 0.08 considered to be a good fit (Hancock & Mueller, 2006).

IV. RESULTS

The purpose of this study was to determine the degree and type of relationship between course selection pathways at the community college and persistence to baccalaureate graduation, as well as the extent to which the percent of credits transferred mediates the relationship between course selection pathways and persistence. However, results from statistical analysis run in the process of model development showed that the relationship between variables hypothesized for inclusion in the model were not invariant across sample sub-groups. Furthermore, results from Spearman's rank correlation (see Table 6) showed an insufficient level of association across hypothesized variables to substantiate model testing through path analysis.

Given that the dependent variable, persistence, is categorical and dichotomous, binary logistic regression was selected for analysis of the research questions. Logistic regression is distinct from standard regression analysis in that the value being predicted is a probability of group membership (Mertler & Vannatta, 2010). In this case, independent variables are used to predict the probability that a student will have one of two outcomes in the fall semester after two years post-transfer: 1) continued enrollment or graduation, and 2) discontinued enrollment prior to graduating. This chapter presents the results from the analyses including (a) descriptive statistics of the variables included in the study, (b) results of assumptions testing, (c) model development and interpretation of results, and (d) evaluation of research questions and hypotheses.

Descriptive Statistics for Sample

Frequency statistics were computed for sample variables and reported separately for traditional and non-traditional students. Table 4 provides detailed results for the

descriptive statistics for the sample, reported by age group. Most of the sample transferred from Austin Community College; 67% of traditional students and 82% of non-traditional students. The distribution across cohort years remained relatively steady with an average of 350 traditional students and approximately 150 non-traditional students in each cohort. Among traditional-age students, nearly 60% entered Texas State as sophomores, while the other 40% entered in their junior year. Non-traditional students trended toward entering with a greater number of credits, with only one quarter entering as sophomores, the majority (57%) entering as juniors, and 19% entering as seniors. The gender and ethnicity breakout across both age groups mirrored the demographics for Texas State students overall. Over 55% are female, 47% identify as White, Non-Hispanic, 39% identify as Hispanic, 7% identify as Black, 4% identify as Asian, and 4% identify as Other.

Whereas demographic characteristics were similar across age groups, two-tailed z-tests for means comparing traditional and non-traditional students showed significant differences across several academic characteristics. Non-traditional students were twice as likely (17% versus 33%) to have completed an associate degree prior to transfer ($z = 3.29$, $p < .001$). Having completed more credits on average at the community college, non-traditional students were also more likely to have withdrawn from or failed a course at the community college level. Forty-two percent of traditional-age students completed all their community college coursework with a passing grade (i.e. CCR of 100%) as opposed to only 29% for non-traditional students ($z = 5.48$, $p < .001$). This is also reflected in the lower average GPA for non-traditional students at the time of transfer. Non-traditional students entered Texas State with a cumulative GPA under 2.5 at a rate

three times as high (34% versus 11%) as traditional-age students ($z = 12.26$, $p < .001$). Non-traditional students were also 20% less likely to have at least 95% of their credits accepted for transfer ($z = 8.18$, $p < .001$). Traditional students were less likely to have completed the full block of state-designated core courses ($z = 4.52$) and less likely to have completed at least half of the recommended courses in the transfer planning guide corresponding to their major ($z = 7.72$, $p < .001$). Traditional students had a persistence rate of 87% as compared to 79% for non-traditional students ($z = 4.59$, $p < .001$).

Table 4

Descriptive Statistics for the Sample Population by Age Group

Characteristic	Traditional		Non-Traditional	
Institution				
ACC	950	67.4	490	82.2
Alamo	460	32.6	106	17.8
Cohort				
AY2012-2013	321	22.8	170	28.5
AY2013-2014	343	24.3	151	25.3
AY2014-2015	354	25.1	146	24.5
AY2015-2016	392	27.8	129	21.6
Ethnicity				
Asian	57	4.0	17	2.9
Black	89	6.3	42	7.1
Hispanic	573	40.6	219	36.7
White	645	45.7	291	48.8
Other	46	3.3	27	4.5
Gender				
Female	785	55.7	341	57.2
Male	625	44.3	255	42.8
Classification at Transfer				
Sophomore	812	57.6	146	24.5
Junior	598	42.4	337	56.5
Senior			113	19.0
Associate Degree				
Yes	232	16.5	194	32.6
No	1,178	83.6	402	67.5

(Continued)

Table 4 (Continued)

Characteristic	Traditional		Non-Traditional	
CCR				
Under 85%	196	13.9	116	19.5
85-99%	619	43.9	310	52.0
100%	595	42.2	170	28.5
Degree Track %				
0%-25%	511	36.3	159	26.7
26-50%	548	38.9	185	31.0
51-75%	277	19.7	192	32.2
76-100%	74	5.3	60	10.1
Core Credits				
0-19	31	2.2	30	5.0
20-29	147	10.4	47	7.9
30-41	535	37.9	144	24.2
42+	697	49.4	375	63
Complete Core				
Yes	179	12.7	123	20.6
No	1,231	87.3	473	79.4
% Credits Accepted				
Under 85%	231	16.4	194	32.6
85-94.9%	509	36.1	236	39.6
95%+	670	47.5	166	27.8
Transfer GPA				
Under 2.5	159	11.3	205	34.4
2.5-2.99	513	36.4	210	35.2
3.0-3.49	519	36.8	113	19.0
3.5-4.0	219	15.5	68	11.4
1st Term Hours				
Part-time	598	57.6	341	57.2
Full-time	812	42.4	255	42.8
GPA Variance				
-.5+ (Transfer Shock)	482	34.4	163	27.4
-.49 - 0	344	24.5	120	20.2
.01 - .49	342	24.4	161	27.1
.5+	235	16.8	151	25.4
Persistence				
Not enrolled	178	12.6	123	19.6
Enrolled/graduated	1,232	87.4	473	79.4

Note. CCR = course completion ratio; GPA = grade point average.

Assumptions Testing

Kruskal-Wallis H test was used to determine whether there were statistically significant differences in persistence outcomes between groups for the independent variables: age group, classification at the time of transfer, transfer institution, gender, ethnicity, cohort, and major. As reported in Table 5, significant differences were found by age group and classification at the time of transfer. The sample was subdivided into five subgroupings based on these characteristics for all further analysis. Sampling distributions did not vary significantly on additional characteristics, and therefor did not require further subdivision of the sample for analysis.

Table 5

Kruskal-Wallis H Test for Group Differences in Persistence – Profile Variables

	Traditional Age			Non-Traditional		
	χ 2	*Df*	*p*	*χ 2*	*Df*	*p*
Sophomores						
Transfer Institution	4.62	1	.03	.79	1	.38
Gender	.00	1	.95	.26	1	.61
Ethnicity	5.78	4	.22	6.80	4	.15
Cohort	2.37	3	.50	2.46	3	.48
Major	60.85	55	.27	39.05	41	.56
Juniors						
Transfer Institution	1.70	1	.19	.20	1	.65
Gender	1.47	1	.23	2.34	1	.13
Ethnicity	4.17	4	.38	2.81	4	.59
Cohort	1.35	3	.72	2.86	3	.41
Major	72.52	58	.10	59.28	50	.17
Seniors						
Transfer Institution				.06	1	.81
Gender				.23	1	.63
Ethnicity				1.59	4	.81
Cohort				2.50	3	.48
Major				24.28	33	.86

Note. Values reported based on assumption of equal distributions across groups (chi-squared with ties).

Endogenous variables were assessed for multivariate and univariate normality using the mvtest command in STATA. Results are reported in Table 6. Multivariate normality was rejected for both traditional and non-traditional student groups based on large values for Mardia's coefficient.

Table 6

Tests for Normality for Predictor Variables

Traditional				
Univariate Normality				
	Skewness	*Kurtosis*	*Adj. Chi2*	*Prob.>Chi2*
CCR	.00	.00	.	.00
Transfer GPA	.01	.00	58.68	.00
GPA Variance	.00	.00	.	.00
1st Term Hours	.00	.00	.	.00
Degree Track %	.53	.13	73.47	.00
Core Credits	.00	.00	2.62	.27
% Credits Accepted	.00	.00	.	.00
Multivariate Normality				
Mardia mSkewness = 9.45		Chi2 (84) = 2227.73		Prob.>Chi2 = 0.00
Mardia mKurtosis = 72.43		Chi2 (1) = 248.64		Prob.>Chi2 = 0.00

Non-Traditional				
Univariate Normality				
	Skewness	*Kurtosis*	*Adj. Chi2*	*Prob>Chi2*
CCR	.00	.05	55.67	.00
Transfer GPA	.69	.00	38.25	.00
GPA Variance	.00	.00	.	.00
1st Term Hours	.00	.00	41.00	.00
Degree Track %	.53	.00	25.47	.00
Core Credits	.00	.09	15.38	.00
% Credits Accepted	.00	.00	.	.00
Multivariate Normality				
Mardia mSkewness = 7.78		Chi2 (84) = 777.20		Prob.>Chi2 = 0.00
Mardia mKurtosis = 68.12		Chi2 (1) = 30.99		Prob.>Chi2 = 0.00

Note. Confidence level set at 95%. Prob. = probability; Adj. = Adjusted; Chi2 = chi-squared.

Endogenous (dependent) variables were tested for multicollinearity using the VIF command in STATA. As shown in Table 7, the calculated VIF values for all variables were under the threshold of 10, indicating no problematic multicollinearity existed.

Table 7

Summary of Variance Inflation Factor (VIF) Values for Predictor Variables

Variable	VIF
CCR	1.66
Transfer GPA	1.73
GPA Variance	1.02
1st Term Hours	1.03
Degree Track %	1.22
Core Credits	1.57
% Credits Accepted	1.04
Associate Degree	1.14
Core Complete	1.33

Note. CCR = course completion ratio; GPA = grade point average; VIF = variance inflation factor.

Spearman's rank correlation was used as a nonparametric measure to test for bivariate correlation between the exogenous (independent) variables with each other and in relation to the endogenous variable for two-year persistence. Full results for Spearman's correlation coefficients are included in Appendix, Table A1. For purposes of interpreting the strength of association, variable pairs with a correlation coefficient between .10 and .29 were considered to have exhibited a small level of association; variables with a correlation coefficient between .30 and .69 a moderate level of association; and correlation coefficients between .70 and 1.0 indicated a high level of association (Tabachnik & Fidell, 2013). Although CCR and community college GPA demonstrated moderately high correlation coefficient values, none were greater than .7 and were therefor not eliminated from the models (Hosmer & Lemeshow, 2007).

Spearman's rank correlation also enables testing the assumption of modularity in path analysis, which requires that the path model can be decomposed into a series of covarying relationships between individual exogenous variables with the endogenous variables they predict (Knight & Winship, 2013). Analysis of the covariance results in The Appendix, Table A1 resulted in the conclusion that there was insufficient strength of covariance between variables to support the development of a path model. Logistic regression was selected as the statistical method to continue with analysis to address the research questions related to the direct relationships between variables due to the dichotomous outcome variable and the nonparametric distribution of variances in the predictor variables.

The following equation was used to determine the adequacy of the number of cases to variables, where *k* is equal to the number of independent variables and *p* is equal to the average of the outcome variable for two-year persistence (Peduzzi et al, 1996).

$$N = 10\ k/p \tag{7}$$

The sample size for all groups exceeded the minimum calculated value, indicating sufficient power for each of the subgroups tested through logistic regression modeling.

Logistic regression also requires the assumption of linearity between continuous independent variables and the logit transformation of the dependent variable. The Box-Tidwell test was selected for use in testing this assumption (Hosmer & Lemeshow, 2000). In this method, the assumption is violated if any of the interaction terms is significant. With five continuous variables, the significance threshold used was $p = .05/5 = .01$. Across all groups, none of the variables were significant and therefore it was concluded that there was a sufficient degree of linearity in the logit for each.

Model Development

Direct logistic regression was performed on two-year persistence as a dichotomous outcome using nine predictor variables: CCR, transfer GPA, variance between pre-transfer GPA and first-term GPA at Texas State, credit hours taken in the first term at Texas State, associate degree completion prior to transfer, the percentage of courses completed from the transfer planning guide corresponding to the declared major at the time of transfer, core credits earned at the community college, and completion of the full 42-credit hour block of core credits prior to transfer. Analysis was performed using STATA logistic and logit commands for each of the five subgroups. Additionally, continuous variables used in the model were transformed to create ordinal variables with values indicated in Table 3. Persistence rates at each level are reported in Table 8.

Table 8

Persistence Outcomes Using Transformed Ordinal Variables for All Groups

	Traditional				Non-Traditional					
	Sophomores		Juniors		Sophomores		Juniors		Seniors	
	n	*Persist*	*n*	*Persist*	*n*	*Persist*	*n*	*Persist*	*n*	*Persist*
Overall	811	85.6	599	89.8	146	75.3	337	78.6	113	86.7
Associate Degree										
Yes	18	100	214	89.6	7	75.6	137	78.8	50	84
No	793	85.2	385	90.2	139	71.4	200	78.5	63	88.9
Transfer GPA										
< 2.5	125	70.4	34	70.6	23	73.9	31	80.6	14	78.6
2.5-2.99	305	87.5	208	88.9	57	71.9	111	71.2	37	83.8
3.0-3.49	278	87.4	241	89.6	43	76.7	123	81.3	44	88.6
3.5-4.0	103	93.2	116	97.4	23	82.6	72	84.7	18	94.4

(Continued)

Table 8 (Continued)

	Traditional				Non-Traditional					
	Sophomores		Juniors		Sophomores		Juniors		Seniors	
	n	*Persist*	*n*	*Persist*	*n*	*Persist*	*n*	*Persist*	*n*	*Persist*
GPA Variance										
-.5+	302	76.5	180	87.2	50	56	92	69.6	21	66.7
-0.49	182	90.1	162	87.7	35	80	65	83.1	20	75
.01 - .49	192	92.2	150	93.3	34	94.1	102	84.3	25	92
.5+	131	90.1	104	92.3	27	81.5	77	77.9	47	97.9
Degree Track %										
0-25%	412	82.8	99	84.9	69	75.4	66	66.7	24	87.5
26-50%	302	87.1	246	85.8	48	70.8	99	75.8	38	86.8
51-75%	83	91.6	194	94.8	25	88	129	83.7	38	86.8
76-100%	14	100	60	98.3	4	50	43	88.4	13	84.6
Core Complete										
No	782	85.7	449	87.8	108	75.0	249	76.7	80	86.3
Yes	29	82.8	150	96.0	2	100.0	88	84.1	33	87.9
Core Credits										
0-19	27	85.2	4	75.0	7	42.9	11	36.4	12	91.7
20-29	143	88.1	4	75.0	24	70.8	15	60	8	87.5
30-41	431	84.9	104	78.8	77	76.6	54	64.8	13	84.6
42+	210	85.2	487	92.4	38	81.6	257	84.4	80	86.2
% Credits Accepted										
< 85%	139	82.7	92	87.0	61	67.2	100	69.0	33	75.8
85-94.9%	282	84.0	227	90.3	51	86.3	148	81.8	37	83.8
95%+	390	87.7	280	90.4	34	73.5	89	84.3	43	97.7

Note. n = sample size; Persist = persistence rate; GPA = grade point average.

A log-likelihood test for goodness-of-fit for the full logistic regression model with all nine predictors against a constant-only model was statistically significant for all five subgroups at $p < .001$, indicating that the predictors, as a set, significantly distinguishing the likelihood of a student persisting beyond two years. The models were also tested for comparison with a perfect (hypothetical) model using the Pearson criterion. All models were found to have an acceptable fit for each of the subgroups, as demonstrated by a non-significant outcome at $p > .05$. Results for each model are provided in Table 9. Full

classification results are reported in Table 10.

Table 9

Logistic Regression Model for Persistence by Age Group and Classification

	Traditional				Non-Traditional			
Predictors	*B*	*SE B*	*OR*	*p*	*B*	*SE B*	*OR*	*p*
Sophomores								
Degree Track %	.97	.56	2.65	.09	-	-	-	-
1st Term Hours	.11	.05	1.41	.02	-	-	-	-
GPA Variance	.85	.19	2.17	.00	.88	.23	2.41	.00
Transfer GPA	.66	.35	1.92	.06	-	-	-	-
CCR	3.85	1.52	45.48	.01	-	-	-	-
Core Credits	-	-	-	-	.05	.03	1.05	.04
% Credits Accepted	-	-	-	-	-	-	-	-
Constant	-4.7	1.32	.07	.01	-2.3	2.70	.10	.39
χ 2		92.15, n = 811				22.99, n = 144		
Psuedo R^2		.14				.14		
Juniors								
Degree Track %	1.52	.69	5.19	.02	1.18	.66	2.97	.07
1st Term Hours	.15	.05	1.16	.00	.12	.04	1.55	.00
GPA Variance	1.07	.26	1.64	.00	1.05	.25	2.84	.00
Transfer GPA	.97	.53	2.41	.09	-	-	-	-
CCR	-	-	-	-	-	-	-	-
Core Credits	.04	.02	1.04	.03	.05	.01	1.06	.00
% Credits Accepted	-	-	-	-	.26	.09	1.29	.01
Constant	.01	.01	-4.9	.00	-5.9	2.13	.01	.01
χ 2		61.00, n = 599				69.92, n = 337		
Psuedo R^2		.15				.19		
Seniors								
Degree Track %					-	-	-	-
1st Term Hours					-	-	-	-
GPA Variance					2.70	.89	15.41	.00
Transfer GPA					2.39	1.31	14.04	.05
CCR					-	-	-	-
Core Credits					-	-	-	-
% Credits Accepted					.52	.22	1.62	.02
Constant					-2.9	4.76	.15	.55
χ 2						33.89, n = 113		
Psuedo R^2						.39		

Note: Threshold for predicted success is set at probability of .75. Completion of the core curriculum and associate degree were not found to be significant across any groups and so were not reported in the table. GPA = grade point average; χ 2 = chi-squared; R^2 = R-squared; n = sample size; B = unstandardized regression weight; SE B = standard error of the regression weight; OR = odds ratio; p = p value.

Table 10

Classification Table for Logistic Regression Model in Table 9

	Traditional		Non-Traditional	
	Actual Outcomes			
Predicted Outcomes	Drop	Persist	Drop	Persist
Sophomores				
Drop	54	69	24	30
Persist	63	625	12	80
Column Totals	117	694	36	110
% Predicted	46.2%	90%	66.7%	72.7%
Juniors				
Drop	22	26	44	56
Persist	39	512	28	209
Column Totals	61	538	72	265
% Predicted	36.1%	95.2%	61.1%	78.9%
Seniors				
Drop			10	8
Persist			5	90
Column Totals			15	98
% Predicted			66.7%	91.8%

In addition to assessing goodness-of-fit, each subgroup was tested for outlier cases. Leverage for each case was compared to the average leverage which equals (k+1)/n, where k is the number of covariates in the model and n is the sample size. The logistic regression analysis was repeated for the model with cases with leverage twice the average for the group removed (Bagheri, Midi, & Imon, 2010). A comparison of chi-squared statistics for the models with and without the outlier cases found no significant changes in model fit with high-leverage cases removed. Additionally, while the coefficients changed, the relative weight and significance of the variables in each model did not change, leaving conclusions unaffected. The decision was made not to remove cases or transform variables for the final analysis.

Individual variables were evaluated for predictive significance using a likelihood ratio test between the full model and a reduced model with each variable removed individually. The chi-square statistics for full models and reduced models were compared to evaluate whether removal of the variable produced a statically significant deterioration in model fit. Although some variables were found to not contribute significantly to the overall model fit, a reduced model omitting non-significant variables did not show a statistically significant improvement in model fit over the original full model. The full model also performed better in predicting actual two-year persistence outcomes. Consequently, the decision was made to report all results for the full model across subgroups. Due to concerns with collinearity from Spearman's results in Appendix, Table A2, the variables for ELNA hours and lost hours were evaluated for potential inclusion in the model separately from the variable for percent of credits accepted. The latter was selected based on having a higher level of significance across models.

All models were significant at $p < .001$. However, results provided in Table 9 show the predictive strength of the model was stronger for non-traditional students. The model explained between 14% (Nagelkerke R^2) of the variance in two-year persistence for sophomores across both age groups, and 15% for traditional juniors. This improved to 19% for non-traditional juniors and 39% for non-traditional seniors. Correct overall classification ranged from 71-89% across groups. The model correctly predicted 46% of traditional sophomores and 36% of traditional juniors who would go on to discontinue their studies within the first year, as compared to approximately two-thirds of non-traditional students across all three years of entry.

While the full model was significant across groups, different predictor variables emerged as significant for each subgroup. Consistent with prior research, variance in GPA from community college to the first semester at the four-year institution was the most stable predictor of two-year persistence. As shown in Table 8, students whose GPA dropped by at least .5 points in the first semester as compared to their average from community college were 15-20% less likely to have graduated or still be enrolled two years later as compared to students whose GPA stayed more consistent or improved in the transition. Community college GPA was significant for both groups of traditional students and for non-traditional seniors. While CCR was highly correlated for traditional sophomores, it did not show to be significant for any of the other subgroups. Out of the three course selection pathways, only completion of transfer planning guide coursework was a significant predictor of two-year persistence.

Discussion of Research Questions

Research question 1 asked whether the number of core credits earned at the community college affects the likelihood of persistence at the four-year institution. As displayed in Table 9, the results from the logistic regression model across all subgroups indicate that the number of core credits earned have no effect on the likelihood of persistence. While core credits earned was found to be a significant contributor to the model at $p < .05$ across traditional juniors, non-traditional sophomores, and non-traditional juniors, the odds ratio for all three groups ranged from 1.04 to 1.06, meaning that an increase in core credits increased the odds of persisting by only .04 to .06, which is negligible. Similarly, completing the full batch of recommended core credits was not found to be a significant predictor for any of the groups. Research question 2 asked

whether earning an associate degree prior to transfer reliably predicts the likelihood of persistence at the four-year institution. Results from the Kruskal-Wallis H Test, displayed in Table 11, indicated no group differences in two-year persistence outcomes between students who earned an associate degree prior to transfer and those who did not. Similarly, an associate degree was not a significant predictor for two-year persistence for any of the subgroups in the logistic regression analysis.

Table 11

Kruskal-Wallis H Test for Group Differences in Persistence – Model Variables

	Traditional Age			Non-Traditional		
	χ 2	*Df*	*p*	*χ 2*	*Df*	*p*
Sophomores						
1st Term Hours	2.05	1	.15	.05	1	.82
Core Complete	.19	1	.66	.66	1	.42
% Credits Accepted	2.86	2	.24	5.47	2	.06
Juniors						
1st Term Hours	11.99	1	.00	2.69	1	.10
AA Degree	.05	1	.85	.01	1	.94
Core Complete	8.35	1	.00	2.10	1	.15
% Credits Accepted	.97	2	.62	8.04	2	.02
Seniors						
1st Term Hours				.97	1	.32
AA Degree				.57	1	.45
Core Complete				.05	1	.82
% Credits Accepted				8.13	2	.02

Note: Values reported based on assumption of equal distributions across groups (chi-squared with ties). AA Degree = associate degree; χ 2 = chi-squared; Df = degrees of freedom; p = p value.

Research question 3 asked whether the percent of recommended transfer planning guide courses completed in a student's declared major at the community college reliably predicts the likelihood of persistence at the four-year institution. The logistic regression model results displayed in Table 9 indicate that completion of transfer planning guide

courses increased a student's odds of persisting beyond the second year by 2.65 times for traditional sophomores, by 5.19 times for traditional juniors, and by 2.97 times for non-traditional juniors. As visible in Table 8, for these groups, persistence rates were 10-15% higher for students who completed over half of the transfer planning guide coursework than for students who completed less than 25% while in community college.

Research Question 4 asked whether the percent of transfer credits accepted reliably predict persistence at the four-year institution. Credit loss does not appear to be a significant factor in two-year persistence for traditional age students. Results from the Kruskal-Wallis H Test, reported in Table 11, indicate no significant differences in two-year persistence across levels of credit acceptance. Similarly, the results from the logistic regression analysis in Table 9 did not include any significant relationship between the percent of credits accepted and two-year persistence.

However, two-year persistence rates for non-traditional juniors and seniors were found to be at least partially predicted by credit loss. Students from these two groups who had less than 85% of their transfer credits accepted by the four-year institution were approximately 10-15% less likely to persist beyond the second year than students with at least 95% credit acceptance. These findings are supported by the results from the Kruskal-Wallis H Test, displayed in Table 11. While results from the logistic regression model in Table 9 do indicate a significant and positive relationship between credit acceptance and two-year persistence, the odds ratios for non-traditional juniors and seniors, at 1.29 and 1.62 respectively, are not as strong as would be expected from an analysis of outcomes in Table 9. This indicates that some of the effect on two-year persistence may be due to the influence of other variables controlled for in the model.

The model from Figure 1 was used to test Research Questions 5, 6, and 7. Figure 1 has been included again for the reader's reference in relation to Table 12.

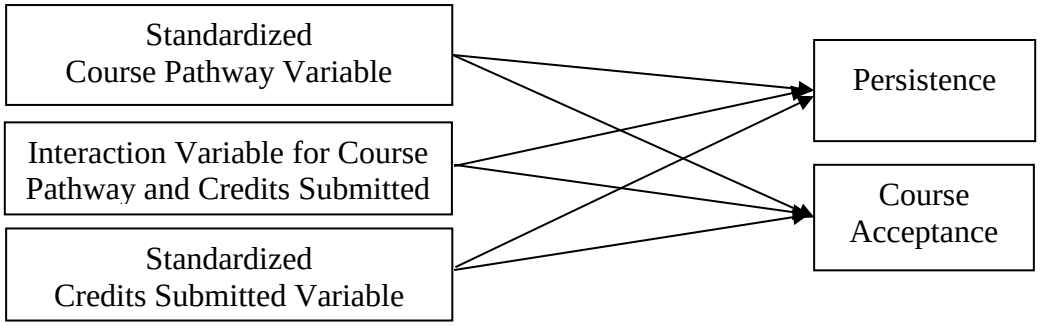

Figure 1. Moderation Model for Credits Submitted and Course Pathway

Each course selection pathway was tested separately for core coursework and degree track completion and results were estimated for both traditional and non-traditional age students. Bootstrapping with 50 iterations was used to correct for non-normality in the data. Results from the model analysis are reported in Table 12.

Table 12

Unstandardized Coefficients, Standardized Coefficients, and Significance Levels for Model in Figure 1 (Bootstrapped Standard Errors in Parentheses)

Parameter Estimate	*Unstandardized*	*Standardized*	*p*
Traditional			
% Credits Accepted ←			
Standardized Degree Track %	.01 (.00)	.15	.00
Degree Track % x Credits Submitted	.00 (.00)	.01	.85
Standardized Core Credits	.03 (.00)	.30	.00
CoreHrs x_Credits Submitted	.00 (.00)	-.03	.34
Standardized Credits Submitted	-.05 (.00)	-.57	.00
Persist ←			
Standardized Degree Track %	.03 (.01)	.10	.00
Degree Track % x Credits Submitted	.01 (.01)	.02	.25
Standardized Core Credits	.02 (.01)	.07	.02
CoreHrs x Credits Submitted	.00 (.01)	.00	.87
Standardized Credits Submitted	.02 (.01)	.06	.04

(Continued)

Table 12 (Continued)

Parameter Estimate	*Unstandardized*	*Standardized*	*p*
Non-Traditional			
% Credits Accepted ←			
Standardized Degree Track %	.01 (.00)	.10	.00
Degree Track % x Credits Submitted	.00 (.01)	.02	.54
Standardized Core Credits	.02 (.00)	.16	.00
CoreHrs x Credits Submitted	.00 (.01)	-.02	.80
Standardized Credits Submitted	-.09 (.01)	-.69	.00
Persist ←			
Standardized Degree Track %	.04 (.02)	.09	.03
Degree Track % x Credits Submitted	.02 (.02)	.04	.35
Standardized Core Credits	.08 (.02)	.18	.00
CoreHrs x Credits Submitted	.01 (.02)	.03	.52
Standardized Credits Submitted	.02 (.02)	.06	.29

Note: Model in Figure 1 run separately using Degree Track % and Core Credits as Course Pathway. Coefficients for Standardized Credits Submitted and % Credits Accepted reported for Degree Track % Model.
Model fit statistics for traditional students:
Degree track model: $\chi^2(7) = 561.09$, $p < .001$; CFI = 1.00; SRMR = .01; RMSEA = .04 Core credits model: $\chi^2(7) = 656.03$, $p < .001$; CFI = 1.00; SRMR = .01; RMSEA = .04
Model fit statistics for non-traditional students:
Degree track model: $\chi^2(7) = 440.94$, $p < .001$; CFI = .97; SRMR = .03; RMSEA = .14. Core credits model: $\chi^2(7) = 468.95$, $p < .001$; CFI = .98; SRMR = .02; RMSEA = .12.

Research Question 5 asked whether the number of credits completed prior to transfer reliably predicts the likelihood of persistence at the four-year institution. Results reported in Table 12 indicate that the number of hours completed at the community college level does not have a direct relationship to persistence at the four-year institution. Additionally, logistic regression analysis for the relationship between total credits submitted and persistence produces an odds ratio for both traditional and non-traditional students equal to one (1.01 and 1.00 respectively), indicating no impact on the odds of two-year persistence due to the number of credits completed at the community college (i.e, an odds-ratio of 1.0 is equivalent to no practical effect or a 50/50 chance outcome). However, it appears that for non-traditional students transferring in their junior and senior year, credit accrual at the community college level may be indirectly associated with

stopping out at the four-year university level inasmuch as it is negatively associated with credit transfer. Table 12 reports a standardized coefficient of -.69 for the number of credits submitted and percent accepted for non-traditional students. Practically speaking, this means that for every ten additional credits completed at the community college, three will not transfer.

Research Question 6 asked whether the number of credits completed prior to transfer moderates the relationship between any of the three defined course selection pathways and the percent of transfer credits accepted. None of the interaction terms reported in Table 12 to test for moderation between degree track and core course completion and hours submitted on percent of transfer credits accepted were significant, indicating that no such moderation relationship exists. To test whether credits submitted has a moderating effect on the relationship between the dichotomous variable for associate degree completion and percent of credits accepted, a series of two-tailed t-tests were conducted to evaluate if differences appeared in mean credit acceptance based on associate degree completion, and whether variation in any such relationship between the variables is moderated by the number of credits completed prior to transfer. The results presented in Table 13 demonstrate that the mean percent of credits accepted for students with an associate and those who transfer without the associate only varies if a student transfers within completion of 61-75 credits, roughly the equivalent of the number of credits required for an associate degree. Credit acceptance does not vary based on whether a student completes an associate degree at all other levels of credits completed.

Table 13

Summary of Results from Two-Tailed T-Tests for Differences in Mean Percent of Credits Accepted by AA Degree and Credit Hours Submitted

	No AA Degree			AA Degree				
	n	*M*	*SD*	*n*	*M*	*SD*	*T-value*	*p*
Non-Traditional								
61-75 Credits	119	.88	.10	35	.93	.06	-2.83	.01
76-90 Credits	97	.89	.10	71	.89	.08	-.02	.99
91-105 Credits	46	.88	.11	38	.88	.08	.09	.93
106-120 Credits	19	.76	.21	13	.70	.13	1.01	.32
>120 Credits	30	.73	.20	33	.68	.21	.88	.39
Traditional								
61-75 Credits	316	.92	.08	118	.95	.05	-3.71	.00
76-90 Credits	114	.89	.11	89	.88	.10	.23	.81

Note: P values are reported for the null hypothesis that the mean differences are not equal to 0. Traditional students transferring with greater than 90 credits were not reported due to insufficient sample. M = mean; n = sample size; SD = standard deviation; p = probability.

Research Question 7 asked whether the number of credits completed prior to transfer moderates the relationship between any of the three defined course selection pathways and persistence at the four-year institution. Again, none of the interaction terms reported in Table 12 between degree track and core course completion and hours submitted on two-year persistence were significant, meaning that credit hours completed at the community college does not have a moderating effect on the relationship between course pathways and two-year persistence. Similar to in Research Question 6, a series of two-tailed t-tests were conducted to evaluate whether there are differences in mean persistence rates based on associate degree completion, and whether variation in any such relationship between the variables is moderated by the number of credits completed prior to transfer. The results presented in Table 14 show that the mean persistence rate does not vary based on whether a student completes an associate degree, and that this stays consistent at all levels of credits completed.

Table 14

Summary of Results from Two-Tailed T-Test for Differences in Mean Persistence by AA Degree and Credits Submitted

	No AA Degree			AA Degree				
	n	*M*	*SD*	*n*	*M*	*SD*	*T-Value*	*p*
Non-Traditional								
61-75 Credits	119	.78	.41	35	.80	.41	-.23	.81
76-90 Credits	97	.80	.40	71	.85	.36	-.68	.50
91-105 Credits	46	.85	.36	38	.82	.39	.38	.70
106-120 Credits	19	.89	.32	13	.62	.51	1.93	.06
>120 Credits	30	.70	.47	33	.76	.44	-.51	.61
Traditional								
61-75 Credits	316	.89	.31	118	.89	.31	.08	.94
76-90 Credits	114	.88	.33	89	.92	.27	-1.02	.31

Note: P values are reported for the null hypothesis that the mean differences are not equal to 0. Traditional students transferring with greater than 90 credits were not reported due to insufficient sample. M = mean; n = sample size; SD = standard deviation; p = probability.

Research Question 8 asked whether the percent of transfer credits accepted mediates the relationship between any of the three defined course selection pathways and persistence at the four-year institution. The model from Figure 1 was used to test for the first two steps required for mediation (Kenny, Kashy, and Bolger; 1998): 1) establishing a relationship between each course selection pathway and persistence; 2) verifying that an effect exists between the course selection pathway and the percent of credits transferred.

As reported for Research Questions 1 and 2, the pathways for core coursework and associate degree did not meet the first criteria, having no significant relationship between the course selection pathways and persistence. From results reported in Table 9, there is a relationship between degree track completion and two-year persistence for some groups. However, as reported in Table 12, degree track was found to have a small direct relationship to the percent of transfer credits accepted, with standardized path coefficients ranging from .10-.15, and therefore it was determined to have failed to meet

the second criteria for mediation. This is further supported by the results from the Spearman's rank correlation analysis, reported in Appendix, Table A1, which indicate an insufficient strength of covariance between the two variables. As such, it was determined that percent of transfer credits accepted does not mediate the relationship between any of the three defined course selection pathways and persistence at the four-year institution.

Analysis of course pathways, credits earned at the community college, and credit acceptance tells a more nuanced story. As shown in Table 15, credit loss increases significantly beyond 60 credit hours earned. Even for the credits that do transfer, many credits are accepted as ELNA credits which are considered general electives by the four-year institution but are not counted toward core coursework nor degree-specific requirements. On average, across the sample, between 10-20% of credits transferred were credited as ELNA. Texas State allows a maximum of 66 credits to be counted toward a degree, with no more than six general elective credits. As reported in Table 15, beyond 45 credit hours completed at the community college, the average number of ELNA credits exceeds the maximum accepted for degree credit. These credits constitute another form of credit loss not typically reported in credit transferability statistics.

An additional variable was calculated to capture the percent of credits earned at the community college level which apply to degree requirements at the four-year institution (% Applied to Degree), excluding non- transferable credits and ELNA credits earned beyond the maximum limit of six credits allowed. As detailed in Table 16, on average, students who transfer after completing 60-90 credit hours can expect between 15-20% of credits earned will not apply to a baccalaureate degree. Said differently, these students will lose approximately one full semester worth of credits.

Table 15

Transfer Credit Loss by Total Passing Credits Earned at the Community College

		Lost Hrs		ELNA Hrs		% Applied to Degree		% Credits Accepted	
	n	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Traditional									
30-45 credits	346	2.1	2.6	4.3	3.5	92.8	8.1	94.8	6.5
46-60 credits	389	4.1	4.3	7.5	6.7	87.2	13.9	92.3	8.0
61-75 credits	434	4.9	4.8	11.1	5.9	84.5	9.6	92.7	7.0
76-90 credits	203	9.3	8.9	13.5	7.2	79.1	11.9	88.7	10.5
91-105 credits	28	18.3	12.2	16.8	8.7	69.3	9.9	81.1	11.6
106-120 credits	4	28.8	12.5	30.0	26.9	51.3	15.3	74.0	15.1
>120 credits	6	54.5	17.8	12.3	5.8	52.0	10.4	57.0	9.9
Non-Traditional									
30-45 credits	26	4.1	3.1	5.3	5.3	86.1	11.2	90.0	7.4
46-60 credits	69	4.7	4.6	7.0	5.3	86.8	10.7	91.4	8.4
61-75 credits	154	7.4	6.8	11.1	7.1	81.3	12.2	89.3	9.8
76-90 credits	168	9.4	7.7	14.3	7.8	78.3	10.7	88.6	9.2
91-105 credits	84	11.5	9.9	18.1	8.7	75.7	12.1	88.2	10.1
106-120 credits	32	29.6	19.9	21.1	13.1	60.0	15.7	73.5	17.9
>120 credits	63	44.0	34.5	31.1	21.0	53.8	14.2	70.5	20.4

Note. Hrs = credit hours; ELNA = elective credit non-advanced; n = sample size; M = mean; SD = standard deviation.

Spearman's rank correlation analysis was done for variables associated with credit transfer, including lost hours and ELNA hours. The results, reported in Appendix, Table A2, reinforce a few key assumptions underlying the hypotheses in this study. Credits accumulation at the community college level is strongly correlated with credit loss upon transfer. For students earning 45 credits or more, two pathways, following degree track recommendations and completing core coursework, are negatively correlated with credit loss upon transfer and positively associated with application of credits earned to degree requirements.

This relationship does not hold for students earning an associate degree prior to transfer. Consistent with the logistic regression results, credit loss is negatively correlated with persistence for non-traditional students who transfer after accruing more

than 105 credits. Completion of core coursework and transfer planning guide recommendations are both moderately correlated with persistence across several groups.

Research Question 9 asked whether the outcomes to the research questions posed in this study differ significantly for non-traditional students (25 and older) than for students 24 years old and under at the time of transfer. As reported in Table 4, significant differences in persistence outcomes were found by age group ($H = 21.08$, $df = 1$, $p = .00$). Average persistence rates were 8% higher for traditional age students (87%) than for non-traditional students (79%). As discussed in response to Research Questions 4 and 5, persistence rates for non-traditional students are also significantly more likely to be affected by credit accumulation at the community college level, likely through its relationship to credit loss during transfer to the four-year institution. As reported in Table 9, persistence for non-traditional students appears to also be more adversely affected by negative variations in GPA in the first semester after transfer and less influenced by cumulative GPA at the community college level than for traditional students.

Implications and recommendations from these results are covered in Chapter 5.

V. CONCLUSIONS AND RECOMMENDATIONS

Introduction

This study is part of a larger body of work seeking to understand the factors contributing to transfer student persistence to baccalaureate degree completion. Scholarship in this area can be described as falling into two categories: understanding factors contributing to transfer out of community college and studies that seek to strengthen understanding of persistence to baccalaureate post-transfer. Both lines of study are important to understanding the reasons behind the low baccalaureate completion rates for students starting higher education at a community college over the past 40 years (Doyle, 2009). This study falls primarily into the latter category; however, it looks to the course selection decisions students make at the community college level as having significant influence on the likelihood of baccalaureate degree completion and the transferability of credits in satisfaction of degree requirements. Policy related to this area has primarily focused on the role of credit transfer and alignment of community college curricular standards with four-year degree requirements. This research also serves to inform the work of policymakers and practitioners seeking to support baccalaureate degree completion for community college students.

Review of the Literature Findings

The primary theoretical frameworks for understanding student persistence to graduation focus on the role of individual characteristics such as pre-college schooling, family background, social and academic integration, and commitment to educational institution and goals, and on the influence of environmental factors such as family support and financial assistance (Tinto, 1975, 1987; Bean, 1980, 1982, 1985; Cabrera et

al., 1993; Pascarella & Terenzini, 1979, 1980). While these theories were primarily developed to explain educational attrition for traditional students at four-year universities, many elements are also relevant for community college students and non-traditional students.

Subsequent research has shown that only half of community college students receive financial aid (Juszkiewicz, 2014) and approximately two-thirds of students work full-time while enrolling part-time (Orozco, & Cauthen, 2009). This is likely particularly true for non-traditional students, one-third of whom care for dependents while pursuing their degree (Juszkiewicz, 2014). These factors are theorized to affect persistence inasmuch as they inhibit institutional integration and predispose students to external shocks which may threaten the feasibility of continued studies and challenge goal commitment.

Accumulation of non-transferable credits is one such external variable found to be correlated with reducing the probability of persisting to baccalaureate graduation (Doyle, 2009; Monaghan & Attewell, 2015). Addressing the transferability of coursework between public community colleges and four-year institutions has been a primary concern of policy makers focused on creating cost-effective pathways to baccalaureate degree attainment. Most states have now pursued mandated articulation for a designated batch of core coursework or the associate degree (Smith, 2010). However, there appears to have been no discernable impact on four-year degree attainment in the states that have pursued these policies (Roksa & Keith, 2010).

Review of the Research Study

This study was designed to test a basic theory of change discussed in the literature

and underlying the push for students to pursue core coursework or associate degree pathways at the community college; namely: 1) that there is a link between each pathway and persistence to baccalaureate degree completion, 2) that the pathways contribute to increasing the proportion of credits applied to a baccalaureate degree upon transfer, and 3) that any increase in persistence can be explained, at least in part, by increased coursework transfer. The same theoretical model was applied to evaluate the impact of following a third pathway, major-specific course recommendations detailed in transfer planning guides prepared by the four-year institution, which is underdeveloped in the literature.

The study used a post ex facto design with a sample of 2,006 transfer students from two of the largest feeder community colleges at a large public research university in Texas. Kruskal-Wallis H test analysis found statistically significant differences in persistence outcomes between students based on age group and class level at the time of transfer. No differences were found based on transfer institution, gender, ethnicity, or cohort. Based on these results, the sample was broken into five subgroups representing levels of classification at transfer and age at matriculation. The sample contained 1,410 traditional age students and 596 non-traditional students. Sample size was determined to be sufficiently large across all subgroups.

A path model was hypothesized to explain two-year persistence based on the degree to which a student completes a coursework pathway prior to transfer. The hypothesized model included percent of credits transferred as a mediating variable between course pathways and persistence, credit hours submitted as a moderating variable for the relationship between each pathway with percent of credits accepted and

persistence. During assumptions testing, Spearman's rank correlation analysis revealed there were insufficient intercorrelations between the hypothesized variables to support the proposed path model. A reduced path model from Figure 1 was used to address Research Question 8 related to the percent of credits transferred as a mediating variable between pathways and persistence. Two additional models were run separately for traditional and non-traditional students to test Research Questions 6 and 7 regarding the role of total credits completed at the community college as a moderating variable for the relationship between course pathways and the percent of credits accepted and between course pathways and persistence.

Logistic regression was used to analyze the relationship between nine predictor variables and persistence at Texas State. The variable for two-year persistence was coded as a dichotomous categorical variable with values representing continued enrollment or graduation (or not) as of the fall semester two years subsequent to the initial term of enrollment. The exogenous predictor variables included the percent of recommended transfer planning guide courses completed prior to transfer (Degree Track %), the number of credit hours taken in the first semester after transfer (1st Term Hours), the variance between first semester GPA at the four-year university and cumulative GPA from the community college (GPA Variance), cumulative GPA from the community college (Transfer GPA), the ratio of courses completed with a passing grade to the total number of courses attempted while at the community college (CCR), completion of the full set of 42-hours of core credits (Core Complete), the number of core credit hours taken at the community college (Core Credits), the percent of passing credit hours completed at the community college which were accepted for credit at the four-year university (% Credits

Accepted), and completion of an associate degree (AA Degree) prior to transfer. The logistic regression model including the nine variables was found to be a significant predictor of two-year persistence at $p < .001$ for all five subgroups.

Discussion of the Results

While the hypothesized path model for relationships between variables common in the research on transfer student persistence was not supported by the data, the findings do point to several important considerations in evaluating the generalizability of results from prior research. A key underlying assumption in the initial research design was that findings from prior research would apply to the population of transfer students at Texas State and, when combined in a path model, would be predictive of persistence. In fact, several of the variables from prior research proved salient in predicting persistence only for some of the subgroups, and several variables demonstrated no predictive capacity across any of the groups. This section discusses the findings of the present study in relation to their initial hypothesized role in the model based on a review of the literature.

Demographic characteristics. Three demographic variables were evaluated in the present study: gender, ethnicity and age. The role of gender and ethnicity in student persistence has been mixed in prior research (Cabrera, et al, 1990; Wawrzynski & Sedlacek, 2003; Tuttle & Musoba, 2013). When tested in this study, neither gender nor ethnicity demonstrated significant group differences in persistence rates. The role of age at the time of transfer has been consistently found to have a strong relationship to persistence in prior research (Calcagano et al, 2006; Goldrick-Rabb, 2010; Honnold & Scott, 1989; Ishitani, 2008; Tuttle & Musoba, 2013). The link between age and persistence was replicated in this study, with non-traditional students stopping out within

the first two years at a rate 8% higher than for traditional students. Beyond the direct influence on persistence, age also affected the relationships between other variables in the study, as discussed further in the following sections.

Part-time enrollment, while not itself a demographic characteristic, is frequently associated with several demographic variables not available in the data, including work hours outside of school, financial support while in school, and the existence of dependents. The part-time enrollment rate in the first semester at Texas State did not vary by age, with approximately 60% of all students enrolling part-time. The link between part-time enrollment and persistence was not as strong as anticipated from the literature review. Kruskal-Wallis H Test results indicated a significant difference in persistence based on part-time enrollment for traditional-age students entering as juniors ($H = 11.99$, $df = 1$, $p = .00$). However, this effect disappeared in the logistic regression results when 1st Term Hours was left as a continuous ratio variable and other variables in the model were held constant.

Credit transfer. There are two aspects to credit transfer which influence persistence: the number of credits transferred, and the number of credits "lost" due to either not transferring for credit or being accepted for credit but not counting toward degree completion. In this study, as in prior research, the variable for credit loss (% Credits Accepted) was expressed as the proportion of credits accepted for transfer over the number of passing credits submitted.

Prior research has found a positive correlation between the number of credits transferred and the likelihood of persistence (McCormick & Carroll, 1997; Koker & Hendel, 2003). In practical terms, this is somewhat intuitive. The further a student

progresses toward a degree, the greater the likelihood of persisting to degree completion. This finding held in the results for this study. Higher class level at the time of entry was linked to higher average persistence rates.

However, the number of credits completed at the community college level was also positively correlated with credit loss, which has been found to be negatively correlated to persistence in prior research (Doyle, 2009; Monaghan & Attewell, 2015). In the present study, lower values for percent of credits accepted were found to be negative correlated with persistence for non-traditional students but had no impact on traditional students.

Academic performance. The relationship between GPA and persistence is one of the longest documented and strongest predictors of persistence for transfer students (Bailey & Weininger, 2002; Crook et al, 2014; Crook & Lavin, 1989; Wang, 2009; Tuttle & Musoba, 2013). In this study, cumulative GPA at the time of transfer was found to be a significant predictor of two-year persistence for traditional students and non-traditional seniors. Transfer shock, first documented by Hills in 1965 and replicated across multiple follow-up studies (Glass, 2002; Ishitani, 2008), was the only predictor of persistence found to be significant across all groups in the Texas State sample. Successful completion of coursework at the community college – operationalized through the course completion ratio (CCR) – was found to have a strong relationship to persistence for traditional students entering as sophomores but was not significant for any other groups.

Course Pathways. The primary objective for this study was to evaluate whether the course pathways students take while in community college affect their likelihood of persistence at the four-year university. The two pathways most commonly promoted in

state policy, the associate degree and the completion of core coursework, have been associated with persistence to baccalaureate completion despite dubious empirical supporting evidence (Couturier, & Jobs for the Future, 2012; Handel, 2012; Hezel Associates, 2010; Hodara & Rodriguez, 2013; Townsend & Wilson, 2006). This study finds no evidence to support the association between these two pathways and transfer student persistence. Results from a Kruskal-Wallis H test for the Texas State sample show no statistical difference in two-year persistence based on associate degree completion. Logistic regression analysis also demonstrated no statistical relationship between two-year persistence and core credit completion or associate degree attainment.

There was, however, evidence to support a link between completion of transfer planning guide coursework and two-year persistence for some groups. Following these degree tracks increased the odds of persisting beyond the second year by 2.65 times for traditional sophomores, by 5.19 times for traditional juniors, and by 2.97 times for non-traditional juniors. In practical terms, students who completed at least half of the recommended courses had two-year persistence rates 10-15% higher than students who completed less than one quarter of the courses. While the hypothesis was that any such increase in persistence would be due to an increase in the transferability of coursework, results from Spearman's rank correlation analysis show only a small degree of relationship between these variables.

Limitations

Most of the limitations of this study are related to the available data and the degree to which the sample is generalizable to the greater population of transfer students. The use of purposive sampling to select one four-year institution and two feeder systems

implies certain limitations to the generalizability of the findings across other institutions. However, single institution studies have the advantage of controlling for unobserved differences across institutions, limiting the variability in the sample due to institutional effects and policies (Ishitani, 2008). Differences across institutions and states are particularly relevant in studies relating to community college transfer given the high level of variability in articulation agreements, state policy, and the resources and emphasis put toward promoting transfer between institutions.

The lack of availability of socioeconomic and financial aid information is another limitation to the study given the strong relationships between income, financial aid, and persistence found in prior research (Brock & Richburg-Hayes, 2006; Geckeler, Carrie, Michael, & Leo, 2008; Patel & Richburg-Hayes, 2011). The initial data request included several data points from the Free Application for Federal Student Aid (FAFSA) and financial aid award. However, the Office of Financial Aid and Scholarships was not able to provide the requested information due to regulations in the Higher Education Act (HEA). The HEA requires that FAFSA data only be used for the application, award and administration of federal aid programs. Any information provided for research purposes must first be de-identified and aggregated. The impact of excluding this information on the logistic regression model is unknown, but likely weakens its predictive capacity.

Implications for Future Research

The findings in the present study demonstrate the importance of evaluating policy recommendations through rigorous research methods. Due to limitations to the generalizability results from this one-institution study, replication at other institutions would help understand whether the findings are unique to Texas State or applicable more

broadly across universities. If replicated, future research might also help clarify the factors contributing to the relationship between transfer planning guide completion and student persistence. If not due to increased transferability of credits, what other contributing factors might be associated? One could hypothesize, as was suggested earlier in the Literature Review section, that assisting students with identifying a major that aligns with their interests and following structured transfer planning guides that align with transfer to a target institution may help improve student engagement and goal commitment. Qualitative or survey research could be helpful to understand whether students who follow the different course pathways communicate differences in goal orientation and motivation.

While screening the data for this study, significant differences in persistence rates were found based on the semester of entry. Based on this finding, the sample was limited to students entering in the fall semester. Future research may help to understand whether such differences in persistence can be attributed to different student entry experiences based on the semester of entry, variations in orientation programming to support transfer students, or student characteristics.

Follow up research might also assist with understanding the differences between traditional and non-traditional students in their response to variables found to be differentially associated with persistence. For example, why is the persistence rate for non-traditional students more likely to be negatively impacted by transfer shock than for traditional-age students? Conversely, why is community college GPA predictive of two-year persistence for traditional-age students but not for non-traditional students entering at the same class level?

A fourth line of research would apply the type of transcript analysis completed for this study and use it to evaluate whether the course pathways influence transfer rates. As has been suggested previously in this paper, the positive association between transfer at higher class levels and higher persistence rates may mask a negative overall relationship between credits completed at the community college level and likelihood of transfer. In other words, are students who set a goal to earn a greater number of credits at the community college level prior to transfer more likely to stop out prior to transfer? This has been suggested by research that shows increases in stop out rates beyond the second year of community college (Managhan & Attewell, 2015). If found to be supported by additional research, it might further influence recommendations as to which course pathway students follow and the timing of transfer.

Implications for Policy and Practice

The findings of the present study challenge several implicit assumptions underlying the push for adoption of policy mandates and institutional programs promoting transfer pathways related to core coursework completion and associate degree attainment. There are several potential implications for policy and practitioners.

Implications for policy. State efforts to promote transfer have laid a groundwork for aligning higher education systems through common course numbering, standardized core curricula, and mandated articulation. However, this has proved insufficient to increase baccalaureate completion for transfer students. One key lesson from this study is the importance of basing policy decisions on rigorous research. Promoting completion of the associate degree as a pathway for students interested in transfer to a four-year university appears to warrant additional research and reevaluation. The results from the

present study did not support a relationship between obtaining an associate degree prior to transfer and baccalaureate completion.

Inasmuch as earning an associate degree prior to transfer was linked to increases in credit accumulation, it also contributed to increased credit loss at the time of transfer. As discussed previously, community colleges play many important roles in workforce preparation, including granting certificates and associate degrees. However, policymakers should consider whether incentive structures which reward community colleges for granting associate degrees may be contributing to a focus on this milestone as part of the transfer pathway. Given the finding that transfer planning guides can help improve persistence rates and that potential benefits are not linked with a specific number of credits to be earned, policies to promote the utilization of transfer planning guides should be evaluated for their potential to improve baccalaureate completion rates for community college students interested in transfer. To the degree possible, lower division coursework included in transfer planning guides should be aligned within degree programs across institutions. Currently, suggested coursework in transfer planning guides for the same major varies across institutions. Greater alignment could help simplify the utilization of transfer planning guides and minimize risk of credit loss based on the ultimate four-year institution attended.

The present study reinforced the need for additional attention to be placed on the effects of credit accumulation at the community college level. Credit loss is an important focus due to its link to persistence to graduation. It is also an economic issue as credit accumulation represents an unnecessary allocation of state dollars, contributes to additional debt for students who borrow toward their degree, and constitutes lost time for

students who could otherwise complete their degrees more efficiently and begin earning at higher baccalaureate salaries earlier.

While students' reasons for accumulating credits vary, from simple personal interest to degree-seeking pursuits, there are potential negative impacts which students may be unaware of in the process. For example, at Texas State, students can transfer a maximum of 66 lower-level credits toward a degree. Approximately half of the sample earned more than 66 credits prior to transfer. Additionally, under federal regulations, a student whose total credit accumulation at any institution exceeds 180 credit hours can no longer qualify for financial aid. Approximately 11% of the non-traditional sample in this study earned in excess of 120 hours at the community college prior to transfer, putting them at very high risk of disqualification from financial aid prior to baccalaureate graduation. A variety of policy solutions may be available, including mandatory notifications to students and individual or institutional incentives for transfer within the first 65 credit hours.

Lastly, the limitations placed on utilization of financial information for research purposes by the Higher Education Act was a significant impediment to addressing the needs of low-income and first-generation families in this research. An exception should be considered to enable the utilization of such information for research. The sample in this study was anonymized, so individual privacy could still be addressed without limiting the ability of researchers to further understand the challenges these students and families face and potential programmatic or policy solutions.

Implications for practice. The use of transfer planning guides appears to offer greater benefits for baccalaureate completion over the alternative pathways available to

students. However, in practice, selecting a transfer planning guide to follow requires a student to first decide on a major of interest and target institution. Some colleges have begun implementing programs, such as Houston Guided Pathways to Success (GPS) in Texas, to assist students with these decisions starting in their first semester. This may take the form of a course in which students learn about topics within a discipline of interest, explore career options that align to a major of interest, conduct informational interviews, or complete personalized degree plans which map out coursework by semester in alignment with degree-specific transfer guides and important milestones in the transfer process. Partnerships between four-year institutions and community colleges could support transfer students to return as peer advisors at the community college to support entering students in understanding degree options and the transfer process. Dual admission programs after the first year might also enable students who have identified a declared major and target institution to have certainty regarding their future admission, even while completing transfer planning guide coursework at the community college. Scholarships targeted at such students could incentivize participation in such programs, promote full-time enrollment, and expedited progress toward the baccalaureate degree.

Technology development and advisor training could further support transfer planning guide utilization. Transfer planning guides exist primarily as documents linked from four-year university websites. Student registration systems at the community colleges could be programmed to identify whether course selections align with major-specific transfer planning guide suggestions across four-year institutions and offer automated suggestions to students for better alignment where applicable. Sharing information with partner four-year institutions on students who select a major and target

institution could support recruitment outreach, similar to how information is shared for students who take college entrance exams and indicate institutions where their scores should be sent. Training for advisors could also enhance understanding of the benefits of following transfer planning guides relative to alternative pathways.

At the four-year university level, the model developed in this study could assist with identifying students at risk of stopping out in the first two years. Programming could be developed to identify students at high-risk of stop out and to engage them with assistance in the form of academic advising or peer support. This could include timely identification of students who appear at risk of transfer shock and follow-up outreach and tutoring. This might be particularly beneficial to non-traditional students who have lower persistence rates overall.

Support programming for non-traditional students may also be tailored to their specific needs. For example, Texas State has invested in an Office of Parent and Family Relations which provides targeted support programming for student parents. Additionally, given that many non-traditional students may need to work full-time to support families, dedicated scholarship opportunities, childcare services, or options for remote attendance could help to provide the flexibility needed to continue coursework while juggling responsibilities.

Summary and Conclusions

This study provided an empirical evaluation of the assumptions underlying some of the most common policies aimed at supporting transfer students to complete their baccalaureate degree. While the generalizability of the findings was limited by the single-institution sample, they may help explain why such policies have not resulted in

increases in baccalaureate completion for transfer students. Neither completion of the associate degree nor core credit completion were associated with two-year persistence at the four-year university level. A third option, major-specific transfer planning guides, not as commonly promoted in policy and practice, was the only pathway demonstrated to have a positive correlation to two-year persistence.

Although promotion of the associate degree and core coursework has dominated state policy in the past few decades, there are some signs this may have begun shifting. In a fall 2017 report by the Texas Higher Education Coordinating Board to the 85th Texas Legislature regarding Senate Bill 1, representatives from Texas public institutions identify the "push" for students to complete an associate degree as one of the most problematic barriers to transfer student success. The same report states that "the amount of time students take to transfer is a significant problem for all students, particularly for underrepresented students" (p.28). The recommendations in the report, including the encouragement of students to choose a major, focus on courses within the major of their chosen degree program, and engage with students and faculty of similar interest are supported by the findings in this study**.**

The present study also served to assess the replicability of findings from past research, and to test the degree to which they hold true across subpopulations within the sample used. Community college GPA, transfer shock, and the percent of credits transferred all showed to be predictive of two-year persistence, but their level of significance and effect size varied by age and class level at the time of transfer. Furthermore, while increased credits at the time of transfer correlated to higher persistence rates, it was also found to contribute to credit loss. On average, students who

transferred in their junior year lost one full semester of credits. While these findings support conclusions reached in many prior studies, they also emphasize the importance of understanding that any finding from one study may only apply to specific subpopulations or may not be replicable in other contexts.

APPENDIX SECTION

Table A1

Summary of Intercorrelations, Means, and Standard Deviations for Predictor Variables

Measure		M	SD	1	2	3	4	5	6	7	8
Full Sample											
1	Persist	.85	.36	1							
2	CCR	.93	.08	.15*	1						
3	CC_GPA	3.03	.43	.14*	.65*	1					
4	GPA_Var	-.24	.88	.19*	-	-.05	1				
5	T1_Hrs	11.43	3.00	.11*	-	.05	-.12*	1			
6	DT_Pct	.38	.24	.11*	.14*	.20*	.06*	-.07*	1		
7	Core_Hrs	42.12	11.89	.11*	.12*	.23*	-	-.06*	.40*	1	
8	Hrs_Accpt	.90	.11	.10*	.09*	.07*	-	.08*	-	-	1
Traditional Sophomores											
1	Persist	.86	.35	1							
2	CCR	.93	.08	.20*	1						
3	CC_GPA	2.96	.42	.17*	.65*	1					
4	GPA_Var	-.34	.87	.22*	-	-	1				
5	T1_Hrs	12.07	2.40	-	-	.06	-.10*	1			
6	DT_Pct	.27	.21	.08*	.09*	.13*	-	-	1		
7	Core_Hrs	35.63	8.61	-	.10*	.17*	.06	-.10*	-	1	
8	Hrs_Accpt	.92	.10	.07	.07*	-	.09*	.21*	-	-	1
Traditional Juniors											
1	Persist	.90	.30	1							
2	CCR	.94	.07	.10*	1						
3	CC_GPA	3.12	.41	.14*	.68*	1					
4	GPA_Var	-.23	.83	.12*	-.09*	-.07	1				
5	T1_Hrs	11.51	2.99	.12*	.08	.14*	-.10*	1			
6	DT_Pct	.46	.22	.17*	.17*	.12*	-	-	1		
7	Core_Hrs	48.20	8.57	.16*	.16*	.15*	-	-	-	1	
8	Hrs_Accpt	.92	.07	-	.13*	.15*	-	.08	.07	-	1

(Continued)

Table A1 (Continued)

	Measure	M	SD	1	2	3	4	5	6	7	8
						Non-Traditional Sophomores					
1	Persist	.75	.43	1							
2	CCR	.90	.08	-	1						
3	CC_GPA	2.97	.45	-	.59*	1					
4	GPA_Var	-.29	.91	.30*	-	-	1				
5	T1_Hrs	10.72	3.21	-	-	-	-	1			
6	DT_Pct	.31	.21	-	-	.14	-	-	1		
7	Core_Hrs	35.38	9.05	.17*	-	-	-	-	.24*	1	
8	Hrs_Accpt	.83	.17	-	-	-	-	-	.26*	.40*	1
						Non-Traditional Juniors					
1	Persist	.79	.41	1							
2	CCR	.92	.08	-	1						
3	CC_GPA	3.10	.45	-	.69*	1					
4	GPA_Var	-.15	.94	.13*	-	-	1				
5	T1_Hrs	10.33	3.61	.16*	-.10	-	-.14*	1			
6	DT_Pct	.48	.24	.17*	.18*	.15*	-	-	1		
7	Core_Hrs	47.63	12.13	.22*	-	.09	-.09	.09	.18*	1	
8	Hrs_Accpt	.87	.12	.14*	-	-	-	-	-	-	1
						Non-Traditional Seniors					
1	Persist	.87	.34	1							
2	CCR	.92	.08	-	1						
3	CC_GPA	3.05	.45	-	.66*	1					
4	GPA_Var	.16	.82	.37*	-	-.22*	1				
5	T1_Hrs	10.67	3.42	-	-	-	-	1			
6	DT_Pct	.46	.23	-	-	.20*	-.19*	-	1		
7	Core_Hrs	48.81	18.85	-	.16	.35*	-.16	-	.46*	1	
8	Hrs_Accpt	.89	.11	.26*	-	-	.19*	-	-	-	1

Note. Results only reported for correlation coefficients ≤ .10. * = p ≤ .05; - = p ≥ .10; Persist = two-year persistence; CCR = course completion ratio; CC_GPA = cumulative grade point average at the time of transfer; GPA_Var = variance between cumulative grade point average at the time of transfer and grade point average earned in the first term at Texas State; T1_Hrs = credit hours enrolled in the first semester at Texas State; DT_Pct = degree track percent completed; Core_Hrs = core credits completed; Pct_Accpt = the percent of credits submitted for transfer which are accepted for credit by Texas State.

Table A2

Summary of Intercorrelations for Credit Transfer Variables

Measure		1	2	3	4	5	6	7	8	9
Traditional - Full Sample										
1	Persist	1								
2	DT_Pct	.13*	1							
3	Core_Hrs	.10*	.37*	1						
4	AA_YN	.05	.22*	.35*	1					
5	Lost_Hrs	-	-	.18*	.16*	1				
6	ELNA_Hrs	-	.17*	.38*	.32*	.19*	1			
7	Degree_Hrs	.04	-	-.16*	-.25*	-.73*	-.66*	1		
8	Pct_Accpt	.05	.05	-	-.08	-.98*	-.08*	.69*	1	
9	Hrs_Submitted	.07*	.43*	.71*	.46*	.47*	.57*	-.47*	-.29*	1
Traditional – 30-45 Credits										
1	Persist	1								
2	DT_Pct	-	1							
3	Core_Hrs	-	.14*	1						
4	AA_YN	-	-	-	1					
5	Lost_Hrs	-	-	-	-	1				
6	ELNA_Hrs	-	-11*	-	-	-	1			
7	Degree_Hrs	.11*	-	.15*	-	-.82*	-.31*	1		
8	Pct_Accpt	-	-	-	-	-.99*	-	.82*	1	
Traditional – 46-60 Credits										
1	Persist	1								
2	DT_Pct	.13	1							
3	Core_Hrs	-	.11*	1						
4	AA_YN	-	-	-	1					
5	Lost_Hrs	-.11*	-.24*	-.24*	-	1				
6	ELNA_Hrs	-	-.09	-	-	-	1			
7	Degree_Hrs	.12*	.27*	.30*	-	-.73*	-.54*	1		
8	Pct_Accpt	.10*	.27*	.27*	-	-.99*	-	.72*	1	

(Continued)

Table A2 (Continued)

Measure		1	2	3	4	5	6	7	8
					Traditional – 61-75 Credits				
1	Persist	1							
2	DT_Pct	.11*	1						
3	Core_Hrs	.09	.08	1					
4	AA_YN	-	-	.10*	1				
5	Lost_Hrs	-	-.21*	-.20*	-.14*	1			
6	ELNA_Hrs	-	-.13*	-	.23*	-.12*	1		
7	Degree_Hrs	-	.29*	.19*	-	-.51*	-.70*	1	
8	Pct_Accpt	-	.22*	.22*	.14*	-.99*	.14*	.50*	1
					Traditional – 76-90 Credits				
1	Persist	1							
2	DT_Pct	.26*	1						
3	Core_Hrs	.22*	-	1					
4	AA_YN	-	-	-	1				
5	Lost_Hrs	-	-.20*	-.30*	-	1			
6	ELNA_Hrs	-		-	-	-.19*	1		
7	Degree_Hrs	-	.28*	.38*	-	-.65*	-.52*	1	
8	Pct_Accpt	-	.20*	.31*	-	-1.0*	.21*	.64*	1
					Traditional – 91-105 Credits				
1	Persist	1							
2	DT_Pct	-	1						
3	Core_Hrs	-	-	1					
4	AA_YN	-	-	-	1				
5	Lost_Hrs	-	-	-	-	1			
6	ELNA_Hrs	-	-	-	.32	-.57*	1		
7	Degree_Hrs	-	-	.61*	-.37*	-.47*	-.34	1	
8	Pct_Accpt	-	-	-	-	1.0*	.59*	.45*	1

(Continued)

Table A2 (Continued)

	Measure	1	2	3	4	5	6	7	8	9
					Non-Traditional - Full Sample					
1	Persist	1								
2	DT_Pct	.13*	1							
3	Core_Hrs	.17*	.38*	1						
4	AA_YN	-	.14*	.19*	1					
5	Lost_Hrs	-.13*	-	-	.14*	1				
6	ELNA_Hrs	-	-	.14*	.23*	.12*	1			
7	Degree_Hrs	.11*	.21*	.12*	-.15*	-.72*	-.62*	1		
8	Pct_Accpt	.15*	.13*	.10*	-.08	-.96*	-	.67*	1	
9	Hrs_Submitted	-	.15*	.31*	.33*	.49*	.56*	-.53*	-.28*	1
					Non-Traditional – 46-60 Credits					
1	Persist	1								
2	DT_Pct	-	1							
3	Core_Hrs	.29*	-	1						
4	AA_YN	-	-	-	1					
5	Lost_Hrs	-	-.26*	-	-	1				
6	ELNA_Hrs	-	-	-	-		1			
7	Degree_Hrs	-	.27*	.20	-	-.78*	-.49*	1		
8	Pct_Accpt	-	.27*	.23	-	-1.0*	-	.77*	1	
					Non-Traditional – 61-75 Credits					
1	Persist	1								
2	DT_Pct	-	1							
3	Core_Hrs	.22*	.15	1						
4	AA_YN	-	.19*	.21*	1					
5	Lost_Hrs	-.20*	-.27*	-.36*	-.22*	1				
6	ELNA_Hrs	-	.16*	-	.20*	-.18*	1			
7	Degree_Hrs	.16*	.40*	.31*	-	-.61*	-.55*	1		
8	Pct_Accpt	.20*	.27*	.37*	.23*	-1.0*	.19*	.59*	1	

(Continued)

Table 2 (Continued)

Measure		1	2	3	4	5	6	7	8
		Non-Traditional – 76-90 Credits							
1	Persist	1							
2	DT_Pct	.23*	1						
3	Core_Hrs	-	.24*	1					
4	AA_YN	-	-	-	1				
5	Lost_Hrs	-	-	-	-	1			
6	ELNA_Hrs	-	-.27*	-	.21*	-.23*	1		
7	Degree_Hrs	-	.32*	.29*	-.14	-.56*	-.57*	1	
8	Pct_Accpt	-	-	-	-	-1.0*	.24*	.55*	1
		Non-Traditional – 91-105 Credits							
1	Persist	1							
2	DT_Pct	.21	1						
3	Core_Hrs	.19	.37*	1					
4	AA_YN	-	-	.25*	1				
5	Lost_Hrs	-	-	-	-	1			
6	ELNA_Hrs	-	-	-.23*	-.27*	-	1		
7	Degree_Hrs	-	.22*	.32*	.24*	-.58*	-.66*	1	
8	Pct_Accpt	-	-	-	-	-1.0*	-	.58*	1
		Non-Traditional – 106-120 Credits							
1	Persist	1							
2	DT_Pct	-	1						
3	Core_Hrs	-	.43*	1					
4	AA_YN	-.33	-	-	1				
5	Lost_Hrs	-.33	-	-.42*	-	1			
6	ELNA_Hrs	-	-	-	-	-.44*	1		
7	Degree_Hrs	-	.30	.67*	-	-.77*	-	1	
8	Pct_Accpt	.33	-	.41*	-	-.99*	.46*	.77*	1

(Continued)

Table 2 (Continued)

Measure		1	2	3	4	5	6	7	8
Non-Traditional – >120 Credits									
1	Persist	1							
2	DT_Pct	-	1						
3	Core_Hrs	-	.48*	1					
4	AA_YN	-	-	-	1				
5	Lost_Hrs	-.31*	-	-	-	1			
6	ELNA_Hrs	-	-	-	-	-.68*	1		
7	Degree_Hrs	.33*	-	.29*	-	-.77*	-	1	
8	Pct_Accpt	.29*	-	-	-	-.99*	.72*	.77*	1

Note. Results only reported for correlation coefficients ≤ .10. * = p ≤ .05; - = p ≥ .10; Persist = two-year persistence; DT_Pct = degree track percent completed; Core_Hrs = core credits completed; AA_YN = associate degree completed prior to transfer; Lost_Hrs = credits not accepted for transfer; ELNA_Hrs = credits accepted for transfer as elective credit non-advanced; Degree_Hrs = credits accepted for transfer and not exceeding maximum elective credits accepted for degree credit; Pct_Accpt = the percent of credits submitted for transfer which are accepted for credit by Texas State.

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