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**FROM DEVELOPMENTAL EDUCATION TO TRANSFER AND BACHELOR'S
DEGREE ATTAINMENT: A STUDY OF COMMUNITY COLLEGE STUDENTS'
LONG-TERM OUTCOMES**

by

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ABSTRACT

FROM DEVELOPMENTAL EDUCATION TO TRANSFER AND BACHELOR'S DEGREE ATTAINMENT: A STUDY OF COMMUNITY COLLEGE STUDENTS' LONG-TERM OUTCOMES

Kathryn Mahaffey Harvey
Old Dominion University, 2019
Director: Dr. Shana L. Pribesh

Community college is the only pathway to higher education for many students. Jenkins and Fink (2016) reported that 40% of new college students entered higher education through a community college. Most of these students aspire to earn a bachelor's degree (Fink 2014). In order to achieve their dream of bachelor's degree attainment, many of these students need to first complete a series of developmental or remedial courses to become college-ready and begin taking curriculum courses. The purpose of this study was to analyze the relationship between developmental education course completion and transfer success by comparing the longitudinal outcomes of students who took developmental courses at a community college with those who did not take developmental courses. The three outcomes analyzed were: 1) transfer to a four-year institution, 2) bachelor's degree attainment, and 3) transfer to a for-profit institution.

In addition to comparing the long-term transfer outcomes of developmental education students versus non-developmental education students, the study also compared two research approaches. One analysis was conducted using a non-matched sample and the other was conducted using a propensity score matched sample. The differences between the results of the two designs was of particular interest. The non-matched sample, for the most part, yielded the typically expected results. However, the more rigorous, matched-sample design indicated that the number of credit hours earned at the community college is the only significant predictor of

vertical transfer to a four-year institution and ultimately to bachelor's degree attainment. The matched sample results did not indicate that completing developmental education courses was a statistically significant predictor of bachelor's degree attainment in either a positive or negative way.

These findings indicate that community college leaders, advisors, and other practitioners should focus their resources and efforts on retaining students and encouraging them to complete a large number of required credits at the community college prior to transferring to a four-year institution. These findings are also indicative of the fact that students who start out in developmental courses can persist and achieve the goal of attaining a bachelor's degree through vertical transfer to a four-year institution.

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This dissertation is dedicated to my husband, Michael, who was with me through it all. Through the long nights, the moments of self-doubt, the panic, the tears – you were with me and you never wavered. Without you, this would not have been possible.

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To my sister, thank you for always letting me know you were proud of me. That meant more than you know. I love you. To my nieces, nephew, and great nieces and nephews, always dream big because you can accomplish great goals that you never thought possible. To my Dad, thank you for being so excited about me completing my Ph.D. It really means the world to me. To my mother, you are everything. I love you so much and wish with all my heart that you could be here to see me accomplish this.

And finally, to my dearest husband, Michael, thank you for putting up with me through it all. Without you, none of this would have been possible. You are my rock. You believed in me even when I didn’t believe in myself. You are the best human I know, and I love you bigger than the sky. I look so forward to the next chapter in our lives together.

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CHAPTER 1

INTRODUCTION

Some students are leaving high school unprepared for college-level coursework. American College Testing (2016) reported that a meager 26% of high school graduates in the United States met college readiness benchmarks in English, reading, mathematics, and science. Alarming, the gap in college-readiness is expanding between students from lower socioeconomic backgrounds and those from families with higher incomes. Between 2013 and 2016, the ACT scores of students whose families earned more than \$80,000 per year increased while the scores of students from families with an annual income less than \$80,000 decreased (American College Testing, 2016). This is a concerning statistic because following the Great Recession more higher paying jobs in the U.S. economy required a college degree. Carnevale, Jayasundera, and Gulish (2015) noted that 2.9 million jobs with annual earnings above \$53,000 were created between 2010 and 2014. Approximately 97% of those jobs were filled by workers who had a minimum of a bachelor's degree.

Whereas, bachelor's degree attainment is a crucial component in gaining access to high paying careers, for many students, the only pathway to a four-year institution and a bachelor's degree is through transfer from a community college. As noted by Jenkins and Fink (2015), two out of five undergraduate students gained access to higher education through the community college system. Further, according to Fry and Cilluffo (2019), the number of dependent students in poverty at public, two-year institutions increased from 13% in 1996 to 27% in 2016. As these statistics illustrate, many students who attend community college cannot afford, nor do they meet the entrance requirements for, a four-year college or university. Consequently, "Vertical transfer from community colleges to four-year institutions therefore offers a critical avenue for upward

mobility for many underserved students, including low-income, first-generation, and racial/ethnic minority students, all of whom are disproportionately represented at community colleges” (Jenkins & Fink, 2015, p. 1).

Additionally, bachelor’s degree attainment is impacted by the fact that many students who start their education at the community college are placed in developmental education courses. According to Chen (2016), approximately 50% of students at public two-year colleges took at least two developmental courses, and the average number of these courses taken was three. Developmental education, as defined by Hagedorn & Kuznetsova (2016), includes “courses, typically in English, mathematics, or reading, with content below college level. Remedial and developmental are often used interchangeably” (p. 63). Developmental course placement is more prevalent at public, two-year colleges for African American, Hispanic, low income, and female students (Chen, 2016). When the statistics regarding transfer and the statistics surrounding developmental education are brought together, it is clear that the pathway from developmental education to transfer and then to bachelor’s degree attainment is crucial for the upward mobility of many underrepresented students.

Moreover, when long-term outcomes of community college students are being examined, it is important to note what type of institutions they are attending after leaving the community college. Of particular concern are the students who leave the community college before graduating with any type of credential to attend a for-profit institution. As noted by Appel and Taylor (2015) students who graduate from for-profit institutions often end up with job opportunities that are much the same as those with a high school diploma but with potentially large amounts of student debt. Tuition at for-profit institutions can be up to six times as costly as a community college and women and minority students are often the target of these institutions’

recruitment efforts (Appel & Taylor, 2015). This study will focus on three outcomes including whether students transfer to a four-year institution or to a for-profit institution and whether they attain a bachelor's degree.

Background

There are a number of correlational studies that followed students from developmental education coursework at a community college through vertical transfer and/or graduation at a four-year institution (Chen, 2016; Crisp & Delgado, 2014; Crisp & Nora, 2010; Monaghan & Attewell, 2015; Mourad & Hong, 2011). The study that is most relevant to the current research was conducted by Mourad and Hong (2011). The researchers tracked students from the community college through college degree attainment. Mourad and Hong (2011) used data from a single community college to examine the factors that determined whether community college students who transferred from the community college to four-year colleges and universities attained a bachelor's degree. The researchers used correlational design and logistic regression in a study that spanned eight years. Mourad and Hong (2011) found that gender and ethnicity were significantly related to the likelihood of students graduating with a bachelor's degree. In an unexpected outcome, Mourad and Hong (2011) noted that the length of time at the community college was inversely proportional to the likelihood of attaining a bachelor's degree. In other words, according to Mourad and Hong (2011), the more semesters students were enrolled at the community college, the less likely they were to attain a bachelor's degree. However, Mourad and Hong (2011) found earning more credits at the community college increased the likelihood of earning a bachelor's degree. Mourad and Hong (2011) also determined that whether students had taken developmental courses or not was "negatively associated with bachelor degree attainment" (p. 9). This finding, however, was not statistically significant (Mourad & Hong,

2011). Although this research was compelling, it lacked a control group concerning participation in developmental education.

In another study that related developmental education to transfer, Crisp and Delgado (2014) used propensity score matching and linear modeling to study the likelihood of students who took developmental courses persisting and transferring to four-year institutions. The researchers found “that students who enroll in developmental courses are systematically different from community college students who do not remediate in gender, ethnicity, first-generation status, academic preparation and experiences during high school, and delayed college entry” (Crisp & Delgado, 2014, p.99). Crisp and Delgado (2014) concluded that remediation, compared to a group with no remediation, decreased the likelihood of students being successful in transfer to a four-year college. In addition to several limitations of this study, including the fact that this study only included students who were 24 or younger, the authors did not follow the students past transfer. Thus, it is still unclear if students with remediation, compared to similar students without remediation, attained bachelor’s degrees at differential rates.

Other studies inform our understanding of the relationship between remediation, transfer and degree attainment. Monaghan and Attewell (2015) used propensity score matching to compare students who started college at less selective four-year colleges to those who started their education at two-year colleges. Unlike Mourad and Hong (2011), the researchers found that the likelihood of attaining a bachelor’s degree was not significantly different statistically for students who earned less than 20 credits versus those who earned 60 credit hours or more (Monaghan & Attewell, 2015). Several years earlier in a less rigorous study, Crisp and Nora (2009) used logistic regression to study Hispanic students who took developmental courses with the intention of transferring to a four-year institution. The researchers examined the factors that

influenced the students' likelihood of success in their second and third year of college and the variance of the factors between students who took developmental courses and those that did not. Crisp and Nora (2009) concluded that "students who required remediation in at least one area and were placed in a developmental course were found to benefit from that experience up until the end of their second year in college" (p.190). These studies along with the bodies of research on developmental education and transfer provide the background for the present research.

Purpose Statement

In an economy that requires bachelor's degree attainment to achieve high income careers and at a time when students are graduating from high school often without the skills necessary for college-level coursework, it is important to analyze the long-term outcomes of developmental education programs. This analysis is especially critical for students from at-risk populations who transfer from community colleges to four-year or for-profit institutions. Since developmental education is often the only means of access to bachelor's degrees for many students, it is vital that the pathway between developmental education at a community college and transfer to and graduation from a four-year institution be examined. According to Jenkins and Fink (2014), vertical transfer provides underserved students with a fundamental path to attaining their bachelor's degree. The purpose of this quantitative study was to use methodologically rigorous methods to compare transfer and bachelor's degree attainment outcomes of students who took developmental courses at a community college with those who did not take developmental courses.

Research Questions

This study focused on the following research questions:

- 1) a) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a four-year college or university?
 - b) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a four-year college or university after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college?
 - c) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a four-year college or university after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load?
- 2) a) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a four-year college or university?
 - b) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a four-year college or university after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college?
 - c) To what extent do students who complete at least one developmental course differ from

similar students who do not complete any developmental courses in terms of transfer to a four-year college or university after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load?

- 3) a) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of bachelor's degree attainment?
 - b) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of bachelor's degree attainment after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college?
 - c) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of bachelor's degree attainment after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load?
- 4) a) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of bachelor's degree attainment?
 - b) To what extent do students who complete at least one developmental course differ from

- similar students who do not complete any developmental courses in terms of bachelor's degree attainment after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college?
- c) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of bachelor's degree attainment after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load?
- 5) a) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a for-profit institution?
- b) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a for-profit institution after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college?
- c) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a for-profit institution after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and

part-time/fulltime load?

- 6) a) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a for-profit institution?
- b) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a for-profit institution after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college?
- c) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a for-profit institution after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load?

Professional Significance

This topic is significant for the following reasons. First, a large percentage of community college students arrive at the two-year institution requiring developmental courses and planning to attain a bachelor's degree. Chen (2016) reported that 68% of students who began their college careers at a public, two-year institution took at least one developmental course and Jenkins and Fink (2014) noted that 80% of community college students aspire to earn a bachelor's degree. It is extremely important to determine the relationship between these two basic components of the community college mission at the institutional level. Second, there is significance in the

potential to show that students who complete more courses prior to transfer are more successful. This could encourage policy makers at both two-year and four-year institutions to create more transfer-friendly articulation agreements. Finally, there is tremendous focus at the community college on career readiness and job training. However, most students who enter community college aspire to earn a bachelor's degree. Therefore, the transfer outcomes for all students are crucial to maintaining the promise of the community college's open access mission.

Overview of Methods

I used two types of quantitative methods for this study. The first was a correlational design that compares all students who took developmental education to those who did not. This design is similar to most studies that examine developmental education and does not protect against selection bias.

The second approach was a more robust quantitative study using a matched samples design to mimic random assignment to treatment and comparison groups. I used propensity score matching to construct the comparison group in order to determine if there were significant differences in the transfer and bachelor's degree attainment outcomes of students who completed developmental education courses at the community college and those who did not. Using propensity score matching, developmental students were matched with non-developmental students using age, gender, race, Pell status, high school GPA, and part-time/fulltime load as the criteria. The non-matched sample size was 604 and the matched sample size was 222. There were 111 students in the developmental student group and 111 students in the non-developmental group.

First-time freshman cohorts in the Associate of Arts and the Associate of Science programs that started in fall 2006, 2007, and 2008 were used as the sample. The dependent

variable for research questions one and two was whether students transferred to a four-year institution within an eight-year period of entering college. The eight-year timeframe was chosen because part-time students were included in the study. There is precedent for the eight-year timeframe in the work of Mourad and Hong (2011). The dependent variable for research questions three and four was whether students attained a bachelor's degree at a four-year institution. The dependent variable for research questions five and six was whether students transferred to a for-profit institution. Each research question was addressed using a non-matched sample model with a series of three logistic regressions and a propensity score matched model utilizing the same three logistic regressions as the non-matched sample. Each progression of the logistic regression sequence added more independent variables. Model one only included whether students completed developmental education courses, yes or no. Next, model two added the number of credit hours earned at the community college, whether an associate degree was earned at the community college, and the number of developmental courses taken at the community college as independent variables. Finally, model three added age, gender, race, Pell status, high school GPA, and part-time/fulltime load status during the students first semester at the community college to the model. National Student Clearinghouse data were used to determine if students transferred to a four-year institution or to a for-profit institution and if they attained a bachelor's degree.

Delimitations

This study was limited to students who were first-time freshmen at a midsized, suburban, public, two-year community college in the southern United States in fall 2006, fall 2007, and fall 2008. This study focused on students who were enrolled in the Associate in Arts and the Associate in Science degrees during the semesters outlined above at one community college.

These programs were selected to limit the focus of the research to only those students who entered college with the goal of transferring to a four-year institution. The sample size was relatively small because of the fact that only one college was studied and only the students who intended to transfer were included. The generalizability of the results was therefore limited.

Definitions of Key Terms

- Academically unprepared – Students who score below established benchmarks on standardized placement tests and are often placed in developmental courses.
- Articulation agreements - Partnerships including written agreements between two-year colleges and four-year institutions outlining how credit hours from the community college will be counted (transferred) at the four-year college or university (U.S. Government Accountability Office, 2017).
- Associate in Arts degree – A two-year degree designed to provide the general education courses that will transfer to a four-year institution as the first two years of a Bachelor of Arts degree.
- Associate in Science degree – A two-year degree designed to provide the general education courses that will transfer to a four-year institution as the first two years of a Bachelor of Science degree.
- At-risk student – Students who have a high likelihood of not persisting to complete their college degree.
- College-level/transfer-level course – Courses that transfer to a four-year institution.
- College ready – “A popular term to identify incoming college students who have scored high enough on placement tests to preclude the need for developmental courses (Hagedorn & Kuznetsova, 2016, p.63).

- Credit hours earned – The number of credit hours that the student successfully completed at the community college.
- Developmental education – “Courses, typically in English, mathematics, or reading, with content below college level. Remedial and developmental are often used interchangeably” (Hagedorn & Kuznetsova, 2016, p.63).
- For-profit institutions – Colleges or universities that are privately funded, taxpaying, and offer postsecondary credentials. These institutions are designed to make a profit and often recruit specific student populations (Iloh, 2016).
- Remedial/remediation – Coursework that teaches content below the college level (Boylan et al., 2017).
- Student transfer – “movement from a two-year institution to a four-year institution with or without first receiving an award (either a certificate or an associate degree) including transfer across institutions, sectors and states” (Shapiro et al., p. 4, 2017).
- Vertical transfer – Students who begin their college education at a community college but finish their bachelor’s degree at a four-year college or university (Crisp & Delgado, 2014).

Summary

According to Jenkins and Fink (2014), 80% of community college students have dreams of earning a bachelor’s degree. For many of these students, developmental education provides the first step to a pathway that can lead to bachelor’s degree attainment through vertical transfer. There is a glut of research focusing on the short-term efficacy of developmental education, but there is less research following students longitudinally from developmental education to their transfer institution. The intent of this research was to compare the transfer and bachelor’s degree

attainment outcomes of students who started community college in developmental education to those of similar students who did not.

The next chapter provides an overview of the research on developmental education and transfer from community college to the four-year institution. Chapter three will detail the methodology that was used in this quantitative study. Chapter four will include the findings of the research, and the final chapter will offer a discussion of the findings including considerations for future research.

CHAPTER 2

LITERATURE REVIEW

In this chapter, the literature surrounding developmental education and transfer will be reviewed. There are limited studies that examine the long-term outcomes of developmental education on transfer success. This chapter will attempt to link the importance of developmental education to transfer and bachelor's degree attainment.

Methodology of Literature Review

A Boolean search was conducted using the Education Source database for the terms transfer AND community college AND developmental education. Only four sources that were peer reviewed and written within the last five years were retrieved. After review of these four articles, only three were found to be relevant to the current study. This same search was conducted using the ERIC database, and no new relevant sources were revealed. The expansion of the search to the past ten years revealed two additional sources. Further sources were found by removing the peer review filter and adding remedial education as an additional keyword search criterion.

As a result of the limited number of sources that contained both developmental and transfer aspects, this literature review will be broken into several sections. The first two sections will cover the history of the transfer mission and developmental education at the community college. Next, the literature review will focus on the factors impacting developmental education success. In the following section, the research that combines developmental education and transfer will be addressed. The final section will review the pertinent literature on vertical transfer. Two major transfer reports released by the Government Accountability Office and the

National Student Clearinghouse Research Center in 2017 will be used to focus the literature review on vertical transfer.

Community College and Transfer: A Brief History

Handel (2013) presented a history of transfer at the community college. In Handel's (2013) synopsis, three trends were identified that still influence transfer policies and outcomes at the present time. First, Handel (2013) argued that "transfer has been and continues to be the central and preeminent mission of the community college" (p.1). Second, Handel (2013) noted that transfer is in the purview of both the two- and four-year institutions; however, four-year institutions have historically been apathetic to students who transfer from community colleges. This indifference, according to Handel (2013), has detracted from the efficacy of vertical transfer. Third, since the inception of the community college, the primary goal of the majority of students entering the two-year institution is to transfer and earn a bachelor's degree "despite sustained effort on the part of two- and four-year leaders to divert students toward sub-baccalaureate goals" (Handel, 2013, p.1).

Handel (2013) noted that the beginning of the community college can be traced back to the competing political ideas of the progressives and the elitists. The progressives advocated for more access and free national education for all people, while the elitists "sought ways of diverting these students to other educational or vocational pathways" (Handel, 2013, p.3). The first junior college was created in 1901 at the University of Chicago by the college's president William Rainey Harper. The vision of Harper was to relegate the lower division courses to a separate entity or junior college. Accepting Harper's idea of an extension of its curriculum, Joliet High School began offering an additional two-year curriculum to its high school seniors. Students who completed the two years of work were offered "advanced standing at the

University of Chicago” (Handel, 2013, p. 4). This two-year extension was eventually offered at a separate location, and the first junior college was created. The idea of junior colleges spread to California and then to other states (Handel, 2013).

From their beginning, Handel (2013) noted, two-year institutions were viewed as both “democratizing” and stratifying (p.5). Along with the idea of separating upper and lower divisions of the baccalaureate degree, Harper also devised the idea of granting an associate degree to those students who completed the two-year curriculum. Therefore, as noted by Handel (2013), from its inception the community college had both a transfer and a workforce mission but “students and parents who took advantage of the presence of two-year institutions in their community viewed them as vehicles of social mobility, stressing the transfer function as the most important avenue of advancement” (Handel, 2013, p.5).

Handel (2013) highlighted the importance of two reports in the history of transfer at the community college. These two reports were the Carnegie Report on Public Higher Education in California and the Truman Report (Handel, 2013). As noted by Handel (2013), both of these documents attempted to push students into two-year terminal degrees as opposed to transfer programs. The Carnegie Foundation (1932) recommended that the central mission of junior colleges in California should not be preparing students for transfer to a four-year institution, but instead the junior colleges should be more focused on two-year degrees for the majority of the students.

Following World War II, the U.S. President’s Commission on Higher Education (1947) recommended that junior colleges be renamed community colleges and that these institutions should be focused on providing a variety of vocational programs. Even in this early report, the commission noted the need for two- and four-year institutions to work together as they stated,

“There is no reason to believe that community colleges, if they are adequately staffed, cannot do as good a job as the lower division of 4-year colleges in preparing students for advanced work in liberal and professional education” (U.S. President’s Commission on Higher Education, 1947, p.70). Throughout the sixties and seventies, Handel (2013) reported, enrollment in vocational programs outpaced the growth in the liberal arts. By the nineties, the mission of the two-year institution had evolved. As mentioned by Levin (2000), “the mission of the community college had less emphasis on education and more on training, less emphasis upon community social needs and more on the economic needs of business and industry, less upon individual development and more upon workforce preparation and retraining” (p. 2). Throughout all of these changes in its mission, one aspect has held constant at the community college, first-time freshman rank transfer to a four-year institution as their number one goal (Handel, 2013). This holds true today with more than 8 out of 10 students at community colleges professing they plan to transfer and pursue a baccalaureate degree (Jenkins & Fink, 2015).

Developmental Education: A Brief History

Complete College America (2016) noted that 42% of all students were placed in developmental or remedial education. As noted by Arendale (2011), however, the need for developmental education programs to prepare students for the rigors of a college education in America is not new. Brier (1984) described the divide between college entrance expectations and student preparation as ever present in American higher education and noted that “the controversy surrounding it is an American educational tradition” (p. 2).

Arendale (2011) contended that the earliest form of developmental education arose during the period extending from the middle 1600s to the 1820s and focused on the education of the white male, elite population. Most of the privileged, white men as described by Arendale

(2011) were studying to be members of the clergy. Developmental education was established to help these white male students meet the admissions requirements of colleges such as Harvard or Yale. These colleges required proficiency in Latin and Greek; and according to Arendale (2011), most of the students who applied did not meet these requirements. The assistance for these students was provided in the form of tutoring to prepare them for college entrance and to meet the continued rigors of college coursework (Arendale, 2011).

As defined by Arendale (2011), the next phase of developmental education spanned from the 1820s to the 1860s. These years, according to Arendale (2011) were characterized by the expansion of the United States to the west. The public education system as noted by Arendale (2011) in these newly settled areas was not well established, and many students were academically unprepared to enter college. Boylan (1988) described that during the early to mid 1800s, more attention was paid to improving the condition of everyday American men as more males were being admitted to colleges. At this time, Boylan (1988) stated, colleges were mainly self-supporting and garnering fees and tuition was the only way for these institutions to stay open. Therefore, any white male with the ability to pay was accepted which led to an influx of unprepared students (Boylan, 1988).

Tutoring was no longer an adequate solution and in 1849, Arendale (2011) noted, the precursor to the present-day developmental education program was created at the University of Wisconsin. This first developmental education program, as described by Arendale (2011), was called the Department of Preparatory Studies and in this department, students were taught study skills and took classes that provided them with remediation in reading, writing, and mathematics. The majority of the students at the University of Wisconsin at this time were enrolled in this preparatory program (Arendale, 2011). The concept of the preparatory academy took off and

according to Brier (1984), by 1889 approximately eight out of ten of the higher education institutions in America offered a remedial program. In a refrain that is very reminiscent of today's discussion of higher education, it was noted by Arendale (2011) that the inclusion of these remedial courses often caused the students to take six years to complete their bachelor's degree.

The timeframe following the Civil War saw a precipitous growth in the number of students attending higher education institutions, and the federal government began to play an increasingly impactful role in shaping the educational landscape (Arendale 2011). The Morrill Act of 1862 stimulated growth in higher education and made it apparent that education should be open to a wider population of students – not just the elite (Boylan, 1988). This growth in access continued the need for preparatory programs and as described by Arendale (2011), 84% of the land grant colleges created by the Morrill Act provided their students with some form of remediation. Following the Civil War, Boylan (1988) reflected, educational opportunities for women and African American students began to expand. The growth, as noted by Boylan (1988), in the need for education for a larger majority of the population was not only reflective of a change in American societal values but also a change in the economy. More of the jobs in this post-Civil War economy required specialized training (Boylan, 1988). Also, during this time period, the Second Morrill Act gave rise to the Historic Black Colleges and Universities and the first community college was established in 1902 (Arendale, 2011). Boylan (1988) reflected that as these different populations gained access to higher education, the higher education “institutions were confronted with the enormous problem of providing the training necessary to prosper in a modern industrial society to a generation of people who had been denied access to education in any form” (pp. 5-6).

Another notable development discussed by Arendale (2011) in this timeframe was the founding of the College Entrance Examination Board (CEEB) in 1890. This board, according to Boylan (1988), created the College Entrance Exam. This standardized test was meant to be a scientific means of screening potential college students and establishing some common measures of high school exit and college entrance criteria (Boylan, 1988).

Fast forward to today, and it is apparent that the discussion surrounding developmental education's role in today's higher education context has long standing roots. It is surprising to realize that the first college entrance test was created in the late 1800s. College readiness and the placement of students into college classes is still being explored today. Developmental education is still controversial and at the center of a decade or more of calls for change. One aspect of developmental education reform movement of the last decade that is most relevant to the current research is placement.

Developmental Education Success Factors

According to Complete College America (2016), only 20% of students at two-year institutions complete the gateway course that corresponds to their developmental education placement. Jaggars and Bickerstaff (2018) highlighted three areas shown by research as contributing factors to the low success rates of developmental education programs. As enumerated by Jaggars and Bickerstaff (2018), those three areas are placement tests that do not appropriately place students, the length of developmental education course progressions, and the instructional methodology used in developmental classes. Placement testing and the developmental education course sequence are relevant to the current research and will be discussed in more detail.

Placement. Traditionally, students are placed into developmental education courses based on the results of a single standardized placement test. According to Jaggars and Hodara (2013), this is done for efficiency. It is much easier for colleges to administer a single placement test that is computer graded to assess the college readiness of community college students than it is to use any other means of placement for student intake (Jaggars & Hodara, 2013). However, this single placement test may be misplacing as many as 1 in 3 students (Belfield & Crosta, 2012; Scott-Clayton, 2012). Another study estimated that approximately one in four students who were placed in development courses could have successfully completed the associated college-level course with a grade of B or higher if they had been placed directly into the higher-level course (Scott-Clayton et al., 2014).

One way to improve placement is to use multiple measures of placement that include high school GPA. Ngo and Kwon (2015) found that using high school GPA and math course completion data as components in the placement decision for college math could improve placement accuracy and decrease student misplacement in developmental math by allowing more students access to higher level math courses. Scott-Clayton et al. (2014) concluded that placing students below their ability level was more prevalent than placing students in courses in which they could not be successful. Their research indicated that using high school GPA and course completion data could greatly reduce the rate of misplacement (Scott-Clayton et al., 2014).

Bahr et al. (2019) found that cumulative high school GPA was a strong predictor of first-year college performance in math and English courses. The researchers also found that a higher cumulative high school GPA was needed to indicate readiness for success in math than in English (Bahr et al., 2019). Bahr et al. (2019) indicated that a high school GPA of 3.0 was

needed to indicate readiness for college-level math and a cumulative high school GPA of 2.6 was necessary to indicated readiness for college English.

Length of Course Sequence. Jaggars and Bickerstaff (2018) noted that the length of the developmental course sequence can be a barrier for some community college students. For example, in the current study's developmental math course sequence, it would take a student who started in basic math three semesters to reach College Algebra. Regardless of whether community college students take developmental courses or not, many of them are forced to leave college because of situations in their lives. Fry and Cilluffo (2019) noted that at public two-year colleges, the number of dependent students who are in poverty is increasing. It is difficult for students to prioritize college and studying when they are concerned about meeting their basic needs such as food, clothing, and shelter. As noted by Jaggars and Bickerstaff (2018), students who are performing well academically face difficulty in maintaining the momentum needed to complete lengthy course progression and as such shortening the course sequence would seem to be one solution that would help students succeed.

According to Jaggars and Bickerstaff (2018), two of the most common models that are currently being used to shorten the developmental course sequence are the co-requisite and compression methods. The compression model is aptly described by its name and as noted by Edgecombe, et al. (2013) is basically the combination of two courses into one semester. For example, in the current study, the two-course sequence required in basic math are completed in one semester. The students meet four days per week instead of two days per week and the semester is broken into two 7.5-week terms. The curriculum of both courses is left relatively unchanged. The co-requisite model, however, does entail more curricular adjustments. In the co-requisite model, students are placed directly into the college-level course, but they are also

required to take a companion developmental course or attend some required support such as tutoring (Jaggars & Bickerstaff, 2018). Jaggars et al. (2015) found that compared with similar students, those taking developmental courses in an accelerated timeframe completed the associated college-level course at a higher rate than those that were not in an accelerated model.

Developmental Education and Transfer

Developmental education and transfer seem to be an unlikely pair. There is a widespread perception that students who take developmental courses never or rarely transfer to four-year institutions. However, this has not been established through research. Monaghan and Attewell (2015) found that students who start their education at a community college are much more likely to have taken developmental courses than students with similar characteristics who started college at a non-selective four-year institution. The reason for this difference, as observed by Monaghan and Attewell (2015), is unknown. In their study of transfer outcomes, the researchers called for more research on developmental education and stated that “at this point, we cannot be sure whether remediation is on the whole beneficial or harmful, or if it has an impact at all” (Monaghan & Attewell, 2015, p.86). Crisp and Delgado (2014), also called attention to the “notable dearth of rigorous research measuring the causal effect of remediation on community college student outcomes” (p. 99).

There is, however, some research linking developmental education and transfer (Chen, 2016; Crisp & Delgado, 2014; Crisp & Nora, 2010; Wood & Palmer, 2016). These researchers used data from national datasets. Three used the Beginning Postsecondary Students Longitudinal Study to examine student success, and the latter used data from the Community College Survey of Student Engagement (CSSE). In their work, Crisp and Nora (2010) conducted logistic regression to analyze the second- and third-year outcomes of Hispanic students who

entered community college in 2003-2004 with the intention of transferring to a four-year institution. Students were considered successful in Crisp and Nora's (2010) study if they were still enrolled at the community college, had transferred to a four-year institution, or had graduated from a community college with a degree at the end of their second and third years. Crisp and Nora (2010) found that in the second year, developmental students were more likely to be successful than students that did not take developmental courses but had lower GPAs in their first year. Crisp and Nora (2010) also found that taking developmental education courses increased the likelihood of vertical transfer. The researchers, however, did not analyze the students' bachelor's degree graduation rates. Crisp and Nora (2010) found three factors that increased the likelihood of successful outcomes in the second year. These factors were more rigorous math courses taken in high school, higher levels of parental education, and the receipt of more financial aid. Further analysis of the developmental students indicated that the number of hours that a student worked, the amount of financial aid received, and the number of credit hours taken were all predictors of their success in the second year of college but not in the third year (Crisp & Nora, 2010).

The characteristics of developmental students are an important aspect of the existing research on developmental students who transfer to a four-year institution. Crisp and Delgado (2014) used propensity score matching to determine that developmental students are different from non-developmental students in "gender, ethnicity, first-generation status, academic preparation and experiences during high school, and delayed college entry" (Crisp & Delgado, 2014, p. 99). Contrary to the results found by Crisp and Nora, Crisp and Delgado (2014) found that taking developmental courses negatively impacted students' likelihood of transferring to a four-year institution. Again, these researchers focused on the likelihood of transferring, but they

did not examine the differences in graduation rates of the students once they had transferred to a four-year institution.

Wood and Palmer (2016) used logistic regression to investigate whether engagement metrics predicted Black male students' intent to transfer. The researchers found that Black male students whose main goal was to transfer were "more likely to be younger, have earned more credits, non-first generation, full-time enrollees, and to have taken developmental courses" (Wood & Palmer, 2016, p.1). Unlike Crisp and Delgado (2014), but similar to Crisp and Nora (2010), Wood and Palmer (2016) indicated that taking developmental education courses positively predicted the students' intent to transfer.

Fincher (2017) and Melguizo, Hagedorn, and Cypers (2008) took different approaches. The researchers did not focus on student success; instead the centerpieces of their studies were cost and student debt. Melguizo, et al. (2008) analyzed the cost of community college attendance including developmental education for students who transferred to four-year institutions in California. The researchers considered the level of developmental education that the students needed upon entry to the community college and divided developmental education into four levels. Level 0 was the most basic, and level 3 was defined as a transfer course. Melguizo et al. (2008) found that the students who placed into the lowest level of developmental education, remained at the community college an average of five years prior to transfer and only successfully transferred two semesters of credit.

Fincher (2017) found that students who entered community college with a well-defined path from community college to a four-year institution had a higher likelihood of graduating with less debt. Fincher (2017) concluded that the least expensive path to a bachelor's degree, and therefore the path with the least debt, was two years at a community college followed by two

years (2 + 2) at a four-year institution. Fincher (2017) briefly mentioned developmental education when defining a 3 + 2 plan. The 3 + 2 path included three years at the community college, allowing for developmental courses and changes in major, followed by two years at a four-year institution. Fincher's (2017) definition of the 3 +2 plan assumed that no transfer credits are lost in the transition between the two- and four-year institutions. Fincher (2017) stated, "Every course that is taken at a community college that effectively replaces a university course on the appropriate baccalaureate degree plan saves money and therefore reduces debt" (p.46). Relevant to the current study, Fincher (2017) found that the 3 + 2 option is less expensive than four years at a university for students who receive Pell Grant funds. This highlights the fact that the most economical way for low income students to attain a bachelor's degree, even for those that spend a year taking developmental courses, is through the community college to university pathway.

In a study that tracked developmental students through to their four-year institutional outcomes, Chen (2016) conducted a descriptive, statistical analysis covering the years 2003 to 2009. Like previous studies using a national dataset, Chen (2016) used data from the 2004/09 Beginning Postsecondary Students Longitudinal Study. However, unlike previous studies conducted by Crisp and Nora (2010) and Crisp and Delgado (2014), Chen also included data from the 2009 Postsecondary Education Transcript Study. Chen (2016) reported that according to the transcript data, 68% of students starting at public two-year colleges during this six-year period enrolled in at least one developmental course. The average number of developmental courses taken by students at public two-year institutions during this timeframe, according to Chen (2016), was three. Chen (2016) categorized developmental course takers as remedial completers, partial remedial completers, and remedial non-completers. The researcher also

compared students according to their academic preparedness. According to Chen (2016), about 3 out of 4 students at public two-year colleges who were deemed weakly prepared based on high school GPA, high school math level, and SAT/ACT scores took developmental courses.

Unfortunately, about 48% of the students who were considered strongly prepared by the same measures also took at least one remedial course (Chen, 2016). At public two-year institutions, Chen (2016) reported that developmental course placement was more prevalent among African Americans, Hispanics, students whose families had lower economic status, and females.

Chen (2016) conducted both bivariate and multivariate analysis. The bivariate analysis revealed that students who completed their developmental courses were likely to achieve better outcomes in transfer, persistence, credit accumulation, and bachelor's degree attainment than those students who only partially completed their remediation or those that did not complete any of their remedial coursework (Chen, 2016). These results did not hold true, however, for students with stronger academic preparedness after using multivariate analysis to control for student characteristics (Chen, 2016). Multivariate analysis showed that there was not a significant difference in bachelor's degree attainment between developmental course completers in English/reading/math and those who did not take developmental coursework (Chen, 2016).

In a study similar to this research and using data from a single institution instead of a national dataset, Mourad and Hong (2011) examined the factors that impact community college students' success in earning a bachelor's degree. The researchers included developmental education as one of the variables to be examined. Mourad and Hong (2011) tracked the fall 2000 cohort of new students from one community college for eight academic years using National Student Clearinghouse data. Students in the cohort who enrolled at a four-year college or university between 2000 and 2008 were used as the sample (Mourad & Hong, 2011). Logistic

regression was utilized to “estimate and interpret the effects of potential explanatory variables on a binary outcome variable” (Mourad & Hong, 2011, p.11). Specifically, the researchers attempted to discern the significant factors that influenced whether community college transfer students earned a bachelor’s degree or not.

The demographic variables considered by Mourad and Hong (2011) included age, gender, ethnicity, and median household income. The possible factors examined by Mourad and Hong (2011) from the community college perspective included the student’s cumulative GPA before transfer, the number of credit hours completed at the community college, the number of semesters that the student attended the community college, associate degree or certificate attainment, type of major, developmental education enrollment, and prior attendance at a four-year institution (Mourad & Hong, 2011). Enrollment in developmental education was not found by Mourad and Hong (2011) to be a significant factor in bachelor’s degree attainment. It was, however, found to be “negatively associated” with attaining a bachelor’s degree (p.9). Interestingly, the researchers found that the more semesters a student spent at the community college, the lower their odds of attaining a bachelor’s degree became. However, Mourad and Hong (2011) also concluded that more credit hours completed and higher GPAs at the community college increased the likelihood of transfer students graduating with a bachelor’s degree.

These findings have clear implications for social mobility and stress the importance of clear articulation agreements between community colleges and four-year institutions. These studies also point out the need to streamline developmental education sequences and to place students in developmental education courses in the most efficient and equitable way possible. The economic advantage of starting college at a more affordable two-year institution is only

realized if the students moves through developmental education courses efficiently and transfer a large number of credits directly to their chosen baccalaureate degree at the four-year institution. The next section will review the research on transfer and bachelor's degree attainment with a focus on factors that lead to student success.

Transfer and Bachelor's Degree Attainment

In 2017, the National Student Clearinghouse Research Center and the GAO released reports on transfer outcomes. These high-profile reports released within one month of one another underscored the importance of analyzing vertical transfer outcomes. The intent of the National Student Clearinghouse Report was to provide two- and four-year institutions with metrics that can be used for setting benchmarks to measure the effectiveness of their vertical transfer initiatives (Shapiro et al., 2017). The GAO report highlighted the need for colleges to better inform students about transfer policies and articulation agreements (U. S. GAO, 2017). Shapiro et al. (2017) defined “student transfer as movement from a two-year institution to a four-year institution with or without first receiving an award (either a certificate or an associate degree) including transfer across institutions, sectors and states” (p.4). The U.S. Government Accountability Office (2017) reported that during the five-year period from 2004 to 2009, approximately “35% of college students transferred to a new school at least once” (para. 1). The U.S. Government Accountability Office (2017) report also noted that students encountered difficulty transferring credits in states where there are not statewide articulation agreements and defined articulation agreements as “transfer agreements or partnerships between schools designating how credits earned at one school will transfer to another” (para. 1). One of the major concerns when students transfer from institution to institution is the loss of credit. The U.S.

Government Accountability Office (2017) reported that students transferring between public institutions during 2004 – 2009 were unable to transfer approximately 37% of their credit hours.

Shapiro et al. (2017) focused on providing definitions and metrics to help community colleges and four- year institutions track students who transfer vertically. As shown in Table 1, the three outcome measures used by Shapiro et al. (2017) to assess community college transfer programs are transfer-out rate, transfer-with-award rate, and transfer-out bachelor’s completion rate.

Table 1

Outcome Definitions

Institutional Outcome	Definition
Transfer-out rate	The number of transfer students who started at the community college divided by the number of students in the community college’s fall 2010 cohort
Transfer-with-award rate	The number of transfer students who started at the community college and earned a certificate or associate degree from that college prior to their earliest enrollment at a four-year institution divided by the number of transfer students in the community college’s fall 2010 cohort
Transfer-out bachelor’s completion rate	The number of transfer students who started at the community college and earned a bachelor’s degree from any four-year institution within six years of community college entry divided by the number of transfer students in the community college’s fall 2010 cohort

Note. Adapted from “Tracking Transfer: Measures of Effectiveness in Helping Community College Students to Complete Bachelor’s Degrees, by Shapiro et al., 2017, p. 5. Copyright 2017 by the National Student Clearinghouse.

The metrics used by Shapiro et al. (2017) to compare community college transfer outcomes were established by Jenkins and Fink (2016). Jenkins and Fink used the same community college metrics to study the national fall 2007 cohort of students. This cohort is more comparable in time to the 2006 – 2008 cohort of students planned for study in this research. Therefore, the Jenkins and Fink (2016) results could be considered benchmarks against which to measure the results in the research outlined in the current study. Also, relevant to the current study, is the fact that Jenkins and Fink (2016) described six years as a “relatively short time for community college students to transfer and earn a bachelor’s degree” (p.6). This assertion lends credence to the use of an eight-year timeframe to ascertain the bachelor’s degree attainment rates of students who start community college in developmental education courses. The eight-year timeframe was used by Mourad and Hong (2011) who noted that eight academic years would presumably be an adequate time for most students to complete a four-year degree, but the researchers added that there may still be some part-time students who continue to pursue their degree even after this length of time. In a study in which the focus will be on the long-term outcomes of developmental students, eight years is a reasonable timeframe.

Conclusion

Developmental education is a conduit for students who are not academically prepared for college level work to upgrade their skills and gain access to higher education. One of the enduring missions of the community college is to provide students with the opportunity to transfer to a four-year institution and attain a bachelor’s degree. Developmental education and vertical transfer in concert with one another can significantly change students’ lives by providing access to higher education and by delivering the skills necessary to navigate it. There is limited

research following students from developmental education to their four-year transfer institution.

The intent of this research is to contribute to the body of research by focusing on this gap.

The next chapter details the methodology that will be used in this quantitative study.

Chapter four includes the findings of the research, and the final chapter offers a discussion of the finding including considerations for future research.

CHAPTER 3

METHODOLOGY

In this chapter I provide a detailed description of the methodology used in this study. First, I restate the purpose statement and research questions. Next, I discuss the research design, covariates, and the sample. Following this, I enumerate and explain the steps used in the propensity score matching process. Next, I discuss the data analysis used to examine the outcomes, and I conclude the chapter with a discussion of the limitations of the study.

Purpose Statement

The purpose of this quantitative study was to compare transfer and bachelor's degree attainment outcomes of students who successfully completed developmental courses at a community college with those who did not successfully complete any developmental courses. Further, the study compared the results of two different study designs. The purpose of this comparison was to discern if the results of the study would be markedly different between a logistic regression using no matching techniques to control for selection bias and a logistic regression using propensity score matching to control for group differences. In the less rigorous design, I made no attempt to reduce selection bias through statistical methods and conducted logistic regression comparing students who completed developmental education courses to those who did not complete developmental education courses. Next, in the second design, I used the more rigorous method of propensity score matching and conducted the same logistic regression progression on the matched groups.

Research Questions

This study focused on the following research questions:

- 1) a) To what extent do students who complete at least one developmental course differ from

- students who do not complete any developmental courses in terms of transfer to a four-year college or university?
- b) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a four-year college or university after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college?
 - c) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a four-year college or university after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load?
- 2) a) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a four-year college or university?
- b) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a four-year college or university after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college?
 - c) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a

four-year college or university after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load?

- 3) a) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of bachelor's degree attainment?
 - b) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of bachelor's degree attainment after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college?
 - c) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of bachelor's degree attainment after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load?
- 4) a) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of bachelor's degree attainment?
 - b) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of bachelor's

- degree attainment after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college?
- c) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of bachelor's degree attainment after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load?
- 5) a) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a for-profit institution?
- b) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a for-profit institution after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college?
- c) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a for-profit institution after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load?

- 6) a) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a for-profit institution?
- b) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a for-profit institution after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college?
- c) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a for-profit institution after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load?

Research Design

This was a quantitative study using two different quantitative methodologies. The first was a correlational design that used logistic regression to compare the entire sample of students who earned credit for developmental education courses to the entire sample of those who did not earn credit for any developmental courses. The second approach was a more robust design using matched samples to mimic random assignment to treatment and comparison groups. Propensity score matching was used to construct the comparison group in order to determine if there were significant differences in the transfer and bachelor's degree attainment outcomes of students who completed developmental education courses at the community college and those who did not.

Ex post facto data were used in both designs to determine if there were significant differences in the transfer and graduation outcomes of students who took developmental education courses and those who did not. Leedy and Ormrod (2016) explained that ex post facto studies are used when the researcher recognizes that data already exists that can be examined to explore connections between previous events and future outcomes. In this study, data were collected from 2006 – 2008 to examine whether there was a relationship between the independent variables of taking developmental courses or not taking developmental courses and the dependent variables of transfer and graduation rates. It was not possible in this design to randomly assign participants to groups. Therefore, a quasi- experimental, matched samples design was used to mimic random assignment and strengthen the design. Developmental students were matched with non-developmental students using age, gender, race, Pell status, high school GPA, and part-time/fulltime load as the criteria and propensity score matching method.

Dependent Variables. The dependent variable for research questions 1 and 2 was whether the student transferred to a four-year institution or not. Students who did not transfer to a four-year institution were recorded as 0, and students who did transfer to a four-year institution were recorded as 1. The dependent variable for questions 3 and 4 was whether the student graduated with a bachelor's degree or not. Students who did not graduate with a bachelor's degree were recorded as 0, and students who did graduate with a bachelor's degree were recorded as 1. Finally, the dependent variable for questions 5 and 6 was whether the student transferred to a for-profit institution. Students who did not attend a for-profit institution were coded as 0 while students who did attend a for-profit institution were coded as 1.

Independent Variables. The independent variable for all research questions was whether the student completed developmental education courses at the community college or not. If

students completed any developmental courses, it was coded as 1. If no developmental courses were completed, it was coded as 0. The number of developmental education courses completed was also considered. The developmental courses included in the study are shown in Table 2. The maximum number of developmental education courses that a student in this study could complete is nine.

Table 2

Developmental Subjects and Levels

Level below transfer	Math	English	Reading
1 level below transfer	Intermediate Algebra	Introduction to Composition	Critical Reading
2 levels below transfer	Introductory Algebra	Basic Developmental English (included two courses)	Developmental Reading
3 levels below transfer	Basic Math (included two courses)		

Covariates. The following variables were used as covariates: credit hours earned at the community college, associate degree attainment at the community college, and number of developmental education courses completed. The number of credit hours earned was recorded as a continuous variable. Associate degree completion at the community college was recorded as a dichotomous variable with completion coded as 1 and non-completion coded as 0. The number of developmental education courses was recorded as a continuous variable. These covariates were selected because the results of other studies concerning these factors have been inconclusive and these variables could potentially be important guidepost for both practitioners

and policy makers. Each covariate is briefly discussed below.

Credit hours earned. Mourad and Hong (2011) concluded that the number of credit hours a student completed at the community college increased the likelihood of students attaining bachelor's degrees. However, in a study using propensity score matching, Monaghan and Attewell (2015) found that the number of credit hours completed at the community college was not a significant factor in bachelor's degree attainment.

Associate degree attainment. Using propensity score matching and comparing students who earned approximately 60 credit hours and did not earn an associate degree to those who did earn an associate degree, Kopko and Crosta (2016) found that earning an Associate of Arts or Associate of Science degree at the community college prior to transferring to a four-year institution had a positive impact on bachelor's degree attainment within six years. However, other recent studies have found that earning an associate degree prior to transfer did not significantly impact bachelor's degree attainment (Turk, 2018.; Wang, Chuang & McCready, 2017).

Number of developmental courses. As noted by Jaggars and Bickerstaff (2018), the length of the developmental education course sequence has been identified as one of the contributing factors influencing student success in developmental education programs. Bettinger and Long (2008) concluded that developmental courses may lower the chances of students completing their degrees because of the time it takes for student to complete the course sequence. Chen (2016) used data from the 2004/09 Beginning Postsecondary Students Longitudinal Study and the 2009 Postsecondary Education Transcript study to follow students from college entry in 2003 to their subsequent outcomes in 2009. Chen (2016) found that the average number of developmental courses taken by students at two-year institutions was three.

Characteristics used for Matching. As described by Lane et al. (2012), one of the most important steps in the propensity score matching process is to select the appropriate covariates that are predictive of group membership. In this case, I wanted to include factors that were predictive of students being included in the developmental course group. Research has shown that students who take developmental courses differ from students who do not need to do so. The differences include demographic, engagement, and academic background factors (Chen 2016; Radford and Horn, 2012). Attewell et al. (2006) found that developmental course taking/remediation was impacted by the age of the student with older students being more likely to take developmental courses than younger students. Chen (2016) noted that in his study of the 2004/09 Beginning Postsecondary Students Longitudinal Study, more female students than male students at two-year colleges enrolled in developmental courses. Attewell et al. (2006) found that African American students enroll in developmental courses at a higher rate than white students. There were also differences, specified by Chen (2016), between remedial and nonremedial students with respect to race, income, and academic performance prior to college. Consequently, the criteria used in the propensity score matching process to match members of the developmental education group to members of the non-developmental education group were age, gender, race, Pell status, high school GPA, and part-time/fulltime load status. Age and high school GPA were recorded as continuous variables with age recorded at the time that the student enrolled in the community college. Gender was coded as 0 for male and 1 for female. Race was recorded as 0 for white and 1 for non-white. Pell status was recorded as a dichotomous variable noted as 1 if the student received a Pell Grant and 0 if no Pell funds were received.

Study Context and Sample

As required, prior to gathering the data, I applied for and received approval to conduct

the research under exempt status 6.4 from the Old Dominion University Education Human Subjects Review Committee. The approval letter is included in Appendix A. I also received permission to conduct the study from the community college at which the research was conducted. The study was conducted using ex post facto data collected by the institutional research department at a single community college in the southeastern United States. According to the U.S. Department of Education (2017), the college was a midsize, suburban, two-year institution. The highest award offered at the college was an associate degree. The student population in fall 2016 was approximately 5000 students, and the overall graduation rate within 150% of the length of normal program time was 19% (U.S. Department of Education, 2017).

The institutional research department at the community college collected the data and provided it to me in Excel spreadsheets. The initial data contained student college ID numbers and demographic data, but student names were not included on the Excel documents. The students' college ID numbers were used to collect additional student level data including the specific developmental courses taken. Names were not attached to the data at any time. The institutional research office at the community tracked the students for eight years using the National Student Clearinghouse (NSC). The NSC data indicated whether the students transferred to another college or university and if so, the name of the institution attended. The NSC data also included whether the student graduated from a four-year institution with a bachelor's degree. This information was included on the Excel spreadsheet provided to me by the community college's institutional research department.

Data were collected for first-time freshman cohorts during a three-year span including fall 2006, fall 2007, and fall 2008. Only students who intended to transfer and were enrolled in the university transfer majors of Associate in Arts and Associate of Science were included in the

study. The overall sample size for the three cohorts combined in the non-matched group was 604 students. The matched sample contained 222 students. There were a sufficient number of students in each group to create large enough matched samples to maintain a satisfactory level of statistical power.

Propensity Score Matching

Leedy and Ormrod (2016) noted that randomly assigning participants to groups was one way to establish causal relationships and control for confounding variables. Since random assignment into two groups was not possible in this study, propensity score matching was used to more closely mimic a randomized study (Austin, 2011). Propensity score matching, as noted by Lane et al. (2012), is a quasi-experimental methodology that “controls for systematic group differences due to self-selection and extends causal inference into these designs” (p. 187). Lane noted that propensity score matching is encouraged by the U.S. Department of Education but is not used often enough in educational research. A propensity score, as defined by Rosenbaum and Rubin (1983), predicts the probability that a study participant will be assigned to a particular treatment group based on a set of observable covariates. In this research, the propensity score was used to determine the probability that a student would be assigned to developmental coursework based on covariates established in previous research to predict such placement.

Jaggars and Bickerstaff (2019) stated that to illustrate the effectiveness of developmental education courses and programs, two groups of students who are similarly prepared for college entry are needed. The authors further noted that at most institutions the creation of these two comparison groups is not possible because all similarly prepared students are placed in developmental courses (Jaggars & Bickerstaff, 2019). In this research, propensity score matching was used to create the two similar groups described by Jaggars and Bickerstaff (2019). One

group of students completed developmental coursework and were matched to another group of similar students who did not complete developmental coursework.

I used the following investigative steps as outlined by Thoemmes (2012) in the propensity score matching process:

1. The researcher carefully chooses covariates that have been shown in previous research to be important pre-treatment predictors of inclusion in the treatment group (Thoemmes, 2012). In this study, six pre-treatment covariates were selected, and the treatment criterion was earning credit for one or more developmental course. The covariates selected were age, gender, Pell status, high school GPA, race, and first semester enrollment status. All of these covariates have been shown in previous research to be factors in student placement into developmental courses.
2. Using the selected covariates, propensities scores were generated using logistic regression (Thoemmes, 2012). The outcome variable was whether the student earned credit for one or more developmental course. The six selected covariates were used as predictors. Propensity scores were estimated using the propensity score matching function in SPSS v.25. As a first step in the propensity score matching process, SPSS conducted a binary logistic regression. The dependent variable was dichotomous and represented whether the students took developmental coursework. Those who did not take developmental education courses were coded as 0 and those who did take developmental education coursework were coded as 1. The independent variables included in the initial analyses were age, gender, Pell status, high school GPA, race and enrollment status. Age was reported as a continuous variable indicating the student's age at the time of entry into the program. Gender was recorded as 0 for

- male and 1 for female. Pell status was indicative of whether the student received funding from a Pell Grant. Zero indicated that the student did not receive any Pell funding while one was recorded for those who did receive the funding. High school GPA was recorded as a continuous variable. Race was reported as either white or non-white with zero equal to white and 1 equal to non-white. First semester enrollment status was indicated as either fulltime or part-time with 1 indicating fulltime and 0 indicating part-time. The purpose of conducting the logistic regression was to determine propensity scores for matching. As noted by Stuart (2010), logistic regression is the most commonly used model to estimate propensity scores.
3. Once the propensity scores were calculated, the actual matching was conducted (Thoemmes, 2012). The “Propensity Score Matching” function located under the data tab in SPSS v.25 was used. This command in SPSS used 1:1 nearest neighbor matching. In this case, I selected the without replacement option. As noted by Thoemmes (2012) this is a very popular and widely used technique to create matches because it is simple and straightforward. I selected a match tolerance of 0.001 as the smallest tolerance that yielded a sufficient number of matches. This tolerance level netted a total of 111 matches. Based on the similarity in their propensity scores, one student who took developmental coursework was matched to another student who did not take developmental coursework.
 4. When the matching is complete, according to Thoemmes (2012), the researcher should check the covariates for balance. As noted by Stuart (2010), graphical representations can provide a quick means to assess the balance of the covariates.

This can be done, explained Stuart (2010) by comparing the distributions of the propensity scores of the matched and non-matched groups. In this study, the first balance check I performed was computing the frequencies of the propensity scores before and after matching. I then visually inspected the histograms before and after matching for similarity. As illustrated when comparing Figure 1 and Figure 2 to Figure 3 and Figure 4, the propensity scores were distributed much differently between the control and treatment group prior to matching. They were, however, distributed very similarly after matching.

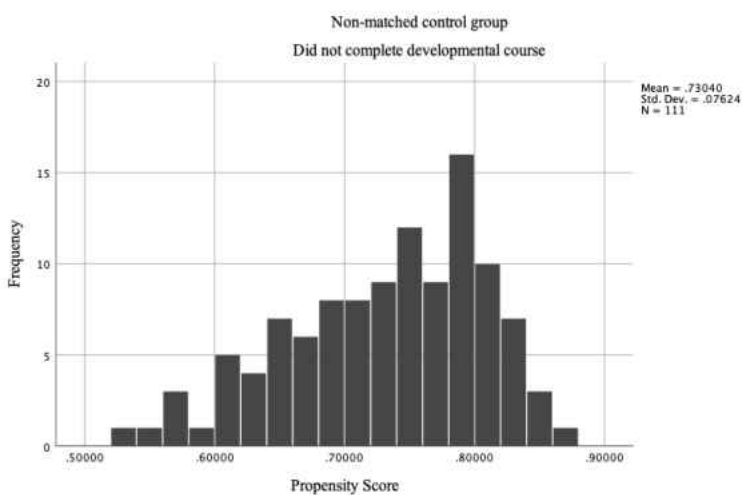


Figure 1. Distribution of propensity scores of students who did not take developmental courses (“control”) before matching.

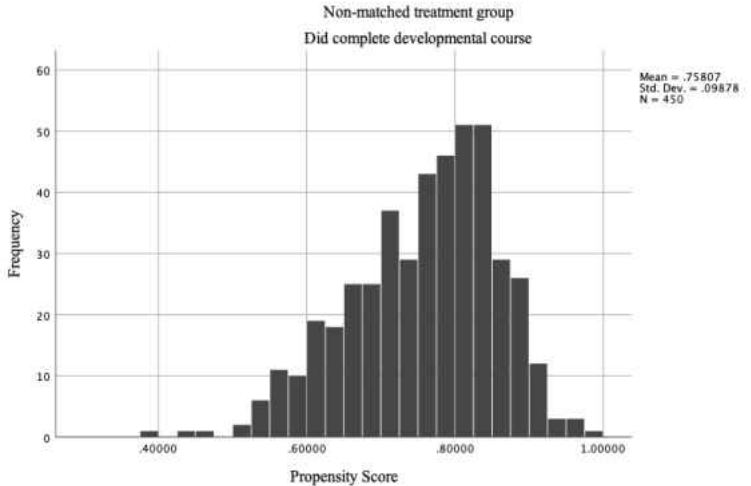


Figure 2. Distribution of propensity scores of students who took developmental education courses (“treatment”) before matching.

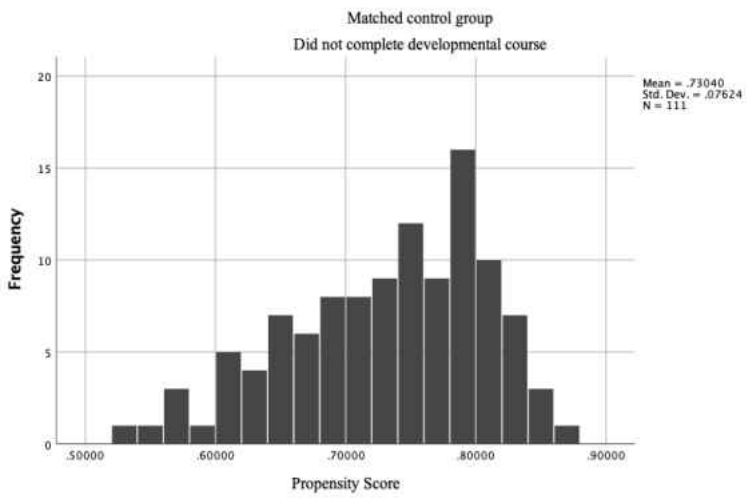


Figure 3. Distribution of propensity scores of students who did not take developmental courses (“control”) after matching.

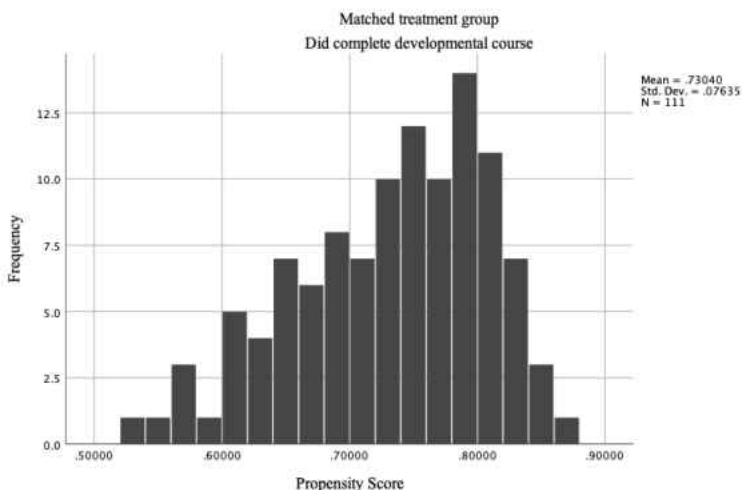


Figure 4. Distribution of propensity scores of students who took developmental education courses (“treatment”) after matching.

As a second check of covariate balance, I calculated the standardized mean difference for each of the covariates used in the propensity score matching process (University of Pennsylvania, 2019). As shown in Table 3, each of the standardized mean differences (SMD) decreased after matching except for the covariate for age. However, all of the SMDs were below the limit of 0.25 that is suggested by Stuart (2010) as a threshold delineating covariate balance.

Table 3

Effect Size of Non-Matched Group vs. Matched group

	Non-matched			Matched		
	No dev ed	Dev ed	SMD*	No dev ed	Dev ed	SMD*
n	154	450		111	111	
Age	18.79	19.27	0.140	18.62	19.14	0.219
Gender	0.47	0.58	0.221	0.48	0.5	0.040
Race	0.23	0.28	0.115	0.26	0.27	0.023
Pell	0.38	0.46	0.162	0.43	0.41	0.040
HS						
GPA	3.1125	2.9652	0.218	3.0102	3.0442	0.052
Load	0.54	0.68	0.289	0.58	0.57	0.020

Data Analysis

The statistical method employed for the analysis was binary logistic regression. Logistic regression is suggested as a best practice for analysis when the outcomes are dichotomous, as they are in this study (Osborne, 2015). The three outcomes analyzed were transfer to a four-year institution, bachelor's degree attainment, and transfer to a for-profit institution. Each of these three outcomes was examined separately using a non-matched sample and a matched sample. Each question focused on whether the likelihood of the outcome was related to successfully completing developmental education courses. Two different samples and three models were used to examine each of these questions. In the first model, the only predictor variable included was whether the student completed any developmental education courses. In the second model, additional predictive factors such as the number of credit hours earned, whether an associate degree was earned, and the number of developmental education courses completed were added. Finally, in the third model, predictor variables that existed prior to the student entering developmental education were added including age, gender, race, Pell status, high school GPA, and part-time/fulltime load status. This pattern of examining each question with a non-matched

and a matched sample was repeated for each outcome. The non-matched sample mimics correlational research that has commonly been used to examine questions around developmental education. The matched sample increases the rigor by using propensity score matching to create a comparison group of similar students.

Limitations

One of the limitations of the study was that it was not possible to assign students to the two groups randomly. As noted by Leedy and Ormrod (2016), when random assignment is not possible, the researcher cannot completely “control for confounding variables that might provide alternative explanations for any group differences observed” (p. 194). This limitation was addressed by using propensity score matching to mimic random assignment. Another limitation was that the study only considered the outcomes of students at one community college. There was also a relatively small sample size, however, the sample was of sufficient size to detect small effect sizes. The majority of students in the sample completed at least one developmental course which may not be similar to other community college campuses. Thus, this may limit the generalizability of the results to other institutions.

Conclusion

The purpose of this study was to compare transfer and bachelor’s degree attainment outcomes of students who completed at least one developmental course at a community college with those who did not complete any developmental courses. The study utilized ex post facto data and two kinds of quantitative designs. Propensity score matching was used to increase the rigor of the study. Age, gender, race, Pell status, high school GPA, and part-time/fulltime load status were used to match developmental students with non-developmental students. Utilizing National Student Clearinghouse data, students were tracked for eight years to determine if they

transferred to a four-year institution (yes or no), if they graduated with a bachelor's degree (yes or no), and finally if they transferred to a for-profit institution (yes or no). Binary logistic regression was used to examine the relationships between the independent variables and the dichotomous dependent variables. Three different logistic regression models were conducted on both the matched and non-matched sample for each outcome. The study has limited generalizability because of its focus on the outcomes of students at one community college. The following chapter provides a detailed description of the results.

CHAPTER 4

RESULTS

The research questions in this study focused on three outcomes comparing students who took and did not take developmental education: 1) transferring to a four-year college or university, 2) earning a bachelor's degree, and 3) attending a for-profit institution. The results of the logistic regressions before and after propensity score matching are presented below.

Transfer to a Four-Year Institution

Research questions one and two focused on examining the predictors that impacted whether students were more or less likely to transfer to a four-year college or university after completing developmental education. Research question one focused on the non-matched sample which is similar to previous research. Research question two increases the rigor by focusing on the same questions but with similar students who were matched using propensity score matching.

RQ1a (Non-matched) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a four-year college or university? The logistic regression conducted on the non-matched sample that included only the predictor of whether a student completed a developmental course yielded a model that was not statistically significant. The results including the regression coefficients (B), the Wald statistics, the significance level, the odds ratio [$\text{Exp}(B)$], and the 95 percent confidence intervals (CI) for odds ratios (OR) of the analysis are listed in Table 4. This indicates that without considering other variables, taking developmental education is not related to transfer to a four-year college.

Table 4.

Non-Matched Results from Logistic Regression Predicting Whether Completing a Developmental Course Impacted the Likelihood of Transferring to a Four-Year Institution

Step	Variable Entered	<i>B</i>	Wald	Significance	Exp(<i>B</i>)	95% C.I. for Exp(<i>B</i>)	
1	Developmental Course Completion	-.078	.158	.691	.925	<i>Lower</i> .628	<i>Upper</i> 1.361
	Constant	-.645	14.453	.000	.525		

RQ 1b (Non-matched) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a four-year college or university after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college? The model with additional community college factors included was statistically significant, $X^2(4, N= 604) = 41.754, p < .001$. The Nagelkerke *R* square was .093. According to Scott (2015), a value below .2 is considered to be a small effect. The model was more successful at predicting those who did not attend a four-year institution than it was at predicting those who did attend with prediction success of 90.6% and 11% respectively. The overall prediction accuracy of this model was 64.2%. The credit hours earned at the community college and the number of developmental courses completed were the variables that had a significant relationship to the likelihood of transferring to a four-year institution. The beta for the number of credit hours was positive and the beta for the number of developmental courses was negative. This indicates that there is a positive relationship between the number of credit hours and the likelihood of transferring to a four-year institution and a negative relationship between the number of developmental courses completed and transfer to a four-year college or university. The exponentiated beta (odds ratio)

for the number of credit hours was 1.02 indicating that for every 1 unit increase in the number of credits hours, the student was 1.02 times as likely to transfer to a four-year institution.

Conversely, the odds ratio for the number of developmental courses was .87 indicating that for every 1 unit increase in the number of developmental courses completed, the student was .87 times as likely to transfer to a four-year institution. The results of this analysis including the regression coefficients (B), the Wald statistics, the significance level, the odds ratio [$\text{Exp}(B)$], and the 95 percent confidence intervals (CI) for odds ratios (OR) of the analysis are listed in Table 5. When additional variables were considered, the fact that students took at least one developmental course was not a statistically significant factor in their likelihood of transferring to a four-year institution. However, the number of developmental courses taken was significant.

Table 5.

Non-Matched Results from Logistic Regression Predicting Whether Developmental Course Completion, Credit Hours Earned, Associate Degree Earned, and Number of Developmental Courses Completed Impacted the Likelihood of Transferring to a Four-Year Institution

Step	Variable Entered	B	Wald	Significance	$\text{Exp}(B)$	95% C.I. for $\text{Exp}(B)$	
						<i>Lower</i>	<i>Upper</i>
1	Developmental Course Completion	-.015	.003	.955	.986	.595	1.632
	Credit Hours Earned	.020	24.444	.000	1.021	1.012	1.029
	Associate Degree Earned	-.151	.244	.621	.860	.472	1.565
	Number of Dev Courses Completed	-.143	5.608	.018	.867	.770	.976
	Constant	-1.244	36.743	.000	.288		

RQ 1c (Non-matched) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a four-year college or university after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load? The model including all ten predictor variables including demographic information was significant, $X^2(10, N=604) = 56.890, p < .001$. The Nagelkerke *R* square was .125 indicating that the model predicts 12.5% of the variance in the outcome. The model predicted the students who did not attend a four-year institution with a success rate of 89.6%. This was slightly lower than the success rate for the previous model. However, this model was better than the previous model at predicting those who did attend a four-year college or university with a prediction success rate of 23%. The overall prediction accuracy of the model was also higher than the previous model with a prediction accuracy of 67.5%. The number of credit hours earned, the number of developmental courses completed, race, and high school GPA were the significant predictors in this model. The beta for the number of credit hours earned and high school GPA were both positive indicating a positive relationship between these predictors and the likelihood of transferring to a four-year college or university. The beta for the number of developmental courses completed was negative indicating a negative relationship between this variable and the likelihood of transferring to a four-year institution. The beta for race was also positive indicating a positive relationship between being non-white and the likelihood of transferring to a four-year institution. The exponentiated beta (odds ratio) for credit hours was 1.018 indicating that for every unit increase in the number of credit hours earned, the student is 1.018 times as likely to transfer to a four-year institution. Similarly, the

odds ratio for high school GPA was 1.445 indicating that for every single point increase in the high school GPA, the student is 1.445 times as likely to transfer to a four-year college or university. On the other hand, the odds ratio for the number of developmental courses completed was .882 indicating that for every 1 unit increase in the number of developmental courses completed, the student is .882 times as likely to transfer to a four-year institution. The odds ratio for race was 1.927 indicating that non-white students were 1.927 times as likely to transfer to a four-year institution as whites. The results of this analysis including the regression coefficients (B), the Wald statistics, the significance level, the odds ratios [$\text{Exp}(B)$], and the 95 percent confidence intervals (CI) for odds ratios (OR) of the analysis are listed in Table 6. This indicates that after controlling for these additional variables, completing at least one developmental education course is not related to transfer to a four-year college or university, but the number of developmental courses taken is statistically significant.

Table 6.

Non-Matched Results from Logistic Regression Predicting Whether Developmental Course Completion, Credit Hours Earned, Associate Degree Earned, Number of Developmental Courses Completed, Age, Gender, Race, Pell status, High School GPA, or Part-time/Fulltime Load Impacted the Likelihood of Transferring to a Four-Year Institution

Step	Variable Entered	<i>B</i>	Wald	Significance	Exp(<i>B</i>)	95% C.I. for Exp(<i>B</i>)	
						<i>Lower</i>	<i>Upper</i>
1	Developmental Course Completion	.011	.002	.965	1.011	.604	1.694
	Credit Hours Earned	.018	15.103	.000	1.018	1.009	1.027
	Associate Degree Earned	-.228	.523	.470	.796	.430	1.476
	Number of Dev Courses Completed	-.126	4.049	.044	.882	.780	.997
	Age	.014	.276	.600	1.014	.963	1.068
	Gender	-.127	.456	.499	.881	.610	1.273
	Race	.656	9.056	.003	1.927	1.257	2.954
	Pell status	-.194	1.020	.313	.824	.566	1.200
	High School GPA	.368	4.804	.028	1.445	1.040	2.008
	Fulltime/part-time load	.259	1.442	.230	1.296	.849	1.978
	Constant	-	11.474	.001	.063		
		2.763					

The traditional analysis, without propensity score matching, indicates that the more developmental education courses students complete, the less likely they are to transfer to a four-year institution. The analysis that follows, however, increases the rigor of the design and uses propensity score matching to more closely mimic random assignment to the treatment and control groups.

RQ 2a (Matched sample) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a four-year college or university? The logistic regression conducted on the matched sample that included only the predictor of whether a student completed a developmental course yielded a model that was not statistically significant. The results including the regression coefficients (B), the Wald statistics, the significance level, the odds ratio [$\text{Exp}(B)$], and the 95 percent confidence intervals (CI) for odds ratios (OR) of the analysis are listed in Table 7. This indicates that without considering other variables, taking developmental education is not related to transfer to a four-year institution.

Table 7.

Matched Sample Results from Logistic Regression Predicting Whether Completing a Developmental Course Impacted the Likelihood of Transferring to a Four-Year Institution

Step	Variable Entered	B	Wald	Significance	$\text{Exp}(B)$	95% C.I. for $\text{Exp}(B)$	
						Lower	Upper
1	Developmental Course Completion	-.041	.021	.886	.959	.546	1.687
	Constant	-.734	13.104	.000	.480		

RQ 2b (Matched sample) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a four-year college or university after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college? The inclusion of the additional predictor variables using the matched sample did produce a significant model $\chi^2(4, N$

$= 222) = 37.172, p < .001$. The Nagelkerke R square was .216 indicating that 21.6% of the variance in the dependent variable was explained by the model. The overall prediction accuracy of the model was 73%. This is the highest prediction accuracy of all of the models thus far. As has been true of the other models, this model was better at predicting the students who did not attend a four-year institution than it was at predicting those who did attend with 86.1% and 45.1% accuracies respectively. The only predictor variable that was significant in this model using the matched sample was the number of credit hours earned. The beta for the number of credit hours earned was positive indicating that the relationship between the number of credit hours earned and the likelihood of transferring to a four-year institution was positive. The exponentiated beta (odds ratio) for the number of credit hours was 1.036 indicating that for every 1 unit increase in the number of credits hours, the student was 1.036 times as likely to transfer to a four-year institution. The results of this analysis including the regression coefficients (B), the Wald statistics, the significance level, the odds ratio [$\text{Exp}(B)$], and the 95 percent confidence intervals (CI) for odds ratios (OR) of the analysis are listed in Table 8. The number of developmental education credit hours completed was no longer significant as it had been in the same analysis conducted on the non-matched sample.

Table 8.

Matched Sample Results from Logistic Regression Predicting Whether Developmental Course Completion, Credit Hours Earned, Associate Degree Earned, and Number of Developmental Courses Completed Impacted the Likelihood of Transferring to a Four-Year Institution

Step	Variable Entered	<i>B</i>	Wald	Significance	Exp(<i>B</i>)	95% C.I. for Exp(<i>B</i>)	
1	Developmental Course Completion	-.075	.025	.873	.927	Lower .367	Upper 2.342
	Credit Hours Earned	.036	21.922	.000	1.036	1.021	1.052
	Associate Degree Earned	-.369	.476	.490	.692	.243	1.972
	Number of Dev Courses Completed	-.232	3.080	.079	.793	.612	1.027
	Constant	-1.762	33.515	.000	.172		

RQ 2c (Matched sample) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a four-year college or university after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load? The model conducted on the matched sample and including all ten predictor variables was significant, $X^2(10, N=222) = 42.407, p < .001$. The Nagelkerke *R* square was .243 indicating that the model predicts 24.3% of the variance in the outcome. This model was 85.4% accurate in predicting those students who did not attend a four-year college or university and 43.7% accurate in predicting those who did attend. The model had a prediction accuracy of 72.1% overall. As in the previous model, the

only significant predictor of transfer to a four-year institution was the number of credit hours earned at the community college. The beta was positive indicating that there was a positive relationship between the number of credit hours completed and the likelihood of transferring to a four-year institution. The exponentiated beta (odds ratio) for credit hours was 1.031 indicating that for every unit increase in the number of credit hours earned, the student is 1.031 times as likely to transfer to a four-year institution. The results of this analysis including the regression coefficients (B), the Wald statistics, the significance level, the odds ratio [$\text{Exp}(B)$], and the 95 percent confidence intervals (CI) for odds ratios (OR) of the analysis are listed in Table 9. When the same analysis was conducted on the pre-matched sample, the number of developmental courses completed, race, and high school GPA were also shown to be significant. This was not the case in this analysis conducted on the matched sample.

Table 9.

Matched Sample Results from Logistic Regression Predicting Whether Developmental Course Completion, Credit Hours Earned, Associate Degree Earned, Number of Developmental Courses Completed, Age, Gender, Race, Pell status, High School GPA, or Part-time/Fulltime Load Impacted the Likelihood of Transferring to a Four-Year Institution

Step	Variable Entered	<i>B</i>	Wald	Significance	Exp(<i>B</i>)	95% C.I. for Exp(<i>B</i>)	
						<i>Lower</i>	<i>Upper</i>
1	Developmental Course Completion	-.119	.060	.806	.888	.343	2.296
	Credit Hours Earned	.031	12.816	.000	1.031	1.014	1.049
	Associate Degree Earned	-.257	.216	.642	.774	.262	2.285
	Number of Dev Courses Completed	-.185	1.777	.182	.831	.633	1.091
	Age	.021	.074	.785	1.021	.880	1.184
	Gender	-.438	1.621	.203	.645	.329	1.267
	Race	.572	2.156	.142	1.771	.826	3.800
	Pell status	-.395	1.278	.258	.674	.340	1.336
	High School GPA	.276	.666	.414	1.318	.679	2.559
	Fulltime/part-time load	.313	.499	.480	1.368	.574	3.260
	Constant	-2.848	2.602	.107	.058		

When comparing the two different designs, it is important to note that in the less rigorous non-matched design, the number of developmental courses was a statistically significant predictor of a lower likelihood of transfer to a four-year institution. However, in the more robust

propensity score matched design, the number of developmental courses completed was not a statistically significant predictor of transfer to a four-year institution. The only significant predictor on transfer to a four-year institution in the more rigorous design was the number of credit hours earned at the community college.

Earning a Bachelor's Degree

Research question three and four focused on examining the predictors that impacted whether students were more or less likely to earn a bachelor's degree. Research question three focused on the non-matched sample and research question four focused on the same outcome and predictors but with similar students who were matched using propensity score matching. Again, three models were used with both the non-matched and matched samples to analyze the likelihood of students earning a bachelor's degree.

RQ 3a (Non-matched) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of bachelor's degree attainment? The logistic regression conducted on the non-matched sample that included only the predictor of whether a student completed a developmental course yielded a model that was not statistically significant. The results including the regression coefficients (B), the Wald statistics, the significance level, the odds ratios [$\text{Exp}(B)$], and the 95 percent confidence intervals (CI) for odds ratios (OR) of the analysis are listed in Table 10. This indicates that without considering other variables, taking developmental education is not related to bachelor's degree attainment.

Table 10.

Non- Matched Results from Logistic Regression Predicting Whether Completing a Developmental Course Impacted the Likelihood of Earning a Bachelor's Degree

Step	Variable Entered	<i>B</i>	Wald	Significance	Exp(<i>B</i>)	95% C.I. for Exp(<i>B</i>)	
1	Developmental Course Completion	-.208	.793	.373	.812	Lower .513	Upper 1.284
	Constant	-1.338	45.403	.000	.262		

RQ 3b (Non-matched) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of bachelor's degree attainment after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college? The model with the additional factors included was statistically significant, $X^2(4, N = 604) = 52.713, p < .001$. The Nagelkerke *R* square was .136. This pseudo *R*² indicates that 13.6% of the variance in bachelor's degree attainment is explained by the independent variables included in the model. This is considered a small effect (Scott, 2015). The model was 98.4% accurate at predicting those who did not earn a bachelor's degree but was not very accurate at predicting those who did earn a bachelor's degree with an accuracy of only 1.8%. The overall accuracy of the model was 80.6%. The number of credit hours earned, completion of an associate degree, and the number of developmental education courses completed were all significant predictors of bachelor's degree attainment in this model. The beta for the number of credit hours earned was the only one with a positive value. The signs of the beta values indicated that while the relationship between credit hours earned and bachelor's degree completion was positive, the relationship between earning an associate degree and completing a bachelor's degree was negative as was the relationship

between the number of developmental courses taken and bachelor's degree attainment. The exponentiated beta (odds ratio) for credit hours earned was 1.033 indicating that for every unit increase in the number of credit hours earned, the student was 1.033 times as likely to earn a bachelor's degree. On the other hand, the odds ratio for earning an associate degree was .330 indicating that students who earned an associate degree were .330 times as likely to earn a bachelor's degree as students who did not earn an associate degree. When examining this result, the reader should consider that in this data set, associate degree completion not only included students who graduated with university transfer degrees (AA or AS), but it also included students who graduated with applied degrees (AAS). This is a limitation of the study and will be addressed in more detail in the next chapter. Similarly, the odds ratio of .821 for the number of developmental courses completed indicated that for every 1 unit increase in the number of developmental courses taken, the student was .821 times as likely to earn a bachelor's degree. The results of this analysis including the regression coefficients (B), the Wald statistics, the significance level, the odds ratios [$\text{Exp}(B)$], and the 95 percent confidence intervals (CI) for odds ratios (OR) of the analysis are listed in Table 11. The results of this non-matched analysis indicate that the more developmental education courses a student completes, the less likely they are to attain a bachelor's degree

Table 11.

Non-Matched Results from Logistic Regression Predicting Whether Developmental Course Completion, Credit Hours Earned, Associate Degree Earned, and Number of Developmental Courses Completed Impacted the Likelihood of Earning a Bachelor's Degree

Step	Variable Entered	<i>B</i>	Wald	Significance	Exp(<i>B</i>)	95% C.I. for Exp(<i>B</i>)	
						<i>Lower</i>	<i>Upper</i>
1	Developmental Course Completion	-.194	.381	.537	.823	.444	1.527
	Credit Hours Earned	.033	43.945	.000	1.033	1.023	1.044
	Associate Degree Earned	-1.108	9.795	.002	.330	.165	.661
	Number of Dev Courses Completed	-.197	6.504	.011	.821	.706	.955
	Constant	-2.274	75.526	.000	.103		

RQ 3c (Non-matched) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of bachelor's degree attainment after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load? The model used to analyze this question that included all ten predictor variables was significant, $X^2(10, N= 604) = 63.978, p < .001$. The Nagelkerke *R* square was .163. This indicates that the independent variables in this model predicted 16.3% of the variance in the dependent variable. The accuracy of the model overall was 80.8%. This was only a slight increase in the model accuracy compared to the previous model. There was a small improvement in this model's accuracy as compared with the

preceding model in predicting those students who would earn a bachelor's degree, but it was still low at 7.2%. The model's success in predicting the students who would not earn a bachelor's degree dropped slightly and was recorded as 97.4%. The number of credit hours earned, associate degree completion, and high school GPA were the three variables that were found to be statistically significant in this model. The number of credit hours and the high school GPA both had positive beta values indicating a positive relationship between these variables and earning a bachelor's degree. However, the beta for associate degree completion was negative indicating that earning an associate degree was negatively related to graduating with a bachelor's degree. The exponentiated beta (odds ratio) for credit hours was 1.028 indicating that for every unit increase in the number of credit hours earned, the student is 1.028 times as likely to earn a bachelor's degree. Similarly, the odds ratio for high school GPA was greater than 1 at 1.572. This indicates that for every 1 unit increase in the students' high school GPA, the student is 1.572 times as likely to attain a bachelor's degree. On the other hand, the odds ratio for earning an associate degree is less than one at .337. This indicates that students who earn an associate degree are .337 times as likely to attain a bachelor's degree. The results of this analysis including the regression coefficients (B), the Wald statistics, the significance level, the odds ratios [$\text{Exp}(B)$], and the 95 percent confidence intervals (CI) for odds ratios (OR) of the analysis are listed in Table 12. It is of note that when the demographic variables were added to this model, the number of developmental courses taken is no longer a statistically significant predictor of bachelor's degree attainment as it was in the previous model in which these pre-treatment characteristics were not controlled.

Table 12.

Non-Matched Results from Logistic Regression Predicting Whether Developmental Course Completion, Credit Hours Earned, Associate Degree Earned, Number of Developmental Courses Completed, Age, Gender, Race, Pell status, High School GPA, or Part-time/Fulltime Load Impacted the Likelihood of Earning a Bachelor's Degree

Step	Variable Entered	<i>B</i>	Wald	Significance	Exp(<i>B</i>)	95% C.I. for Exp(<i>B</i>)	
						<i>Lower</i>	<i>Upper</i>
1	Developmental Course Completion	-.142	.196	.658	.868	.463	1.626
	Credit Hours Earned	.027	25.654	.000	1.028	1.017	1.039
	Associate Degree Earned	-1.088	8.993	.003	.337	.165	.686
	Number of Dev Courses Completed	-.148	3.539	.060	.862	.739	1.006
	Age	.004	.014	.906	1.004	.933	1.082
	Gender	-.042	.033	.857	.959	.611	1.506
	Race	.222	.643	.423	1.249	.726	2.149
	Pell status	-.313	1.729	.189	.731	.459	1.166
	High School GPA	.452	4.648	.031	1.572	1.042	2.371
	Fulltime/part-time load	.422	2.175	.140	1.525	.870	2.673
	Constant	-3.858	12.365	.000	.021		

RQ 4a (Matched sample) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental

courses in terms of bachelor's degree attainment? The model that included only the independent variable of whether students completed one or more developmental course was not significant. The results including the regression coefficients (B), the Wald statistics, the significance level, the odds ratio [$\text{Exp}(B)$], and the 95 percent confidence intervals (CI) for odds ratios (OR) of the analysis are listed in Table 13. These results indicate without including other variables completing developmental courses is not a statistically significant predictor of bachelor's degree attainment.

Table 13.

Matched Sample Results from Logistic Regression Predicting Whether Completing a Developmental Course Impacted the Likelihood of Earning a Bachelor's Degree

Step	Variable Entered	B	Wald	Significance	$\text{Exp}(B)$	95% C.I. for $\text{Exp}(B)$	
						Lower	Upper
1	Developmental Course Completion	-.187	.279	.597	.829	.415	1.659
	Constant	-1.455	36.061	.000	.233		

RQ 4b (Matched sample) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of bachelor's degree attainment after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college? The model with the additional factors included was statistically significant, $X^2(4, N = 222) = 17.650, p < .05$. The Nagelkerke R square was .126. This pseudo R^2 indicates that 12.6% of the variance in bachelor's degree completion was explained by the predictor variables included in the model. This model had an overall predictive accuracy of 81.5%, but it was not successful at predicting those students who

would earn a bachelor's degree with an accuracy of 0% for this metric. The model predicted the number who would not earn a bachelor's degree with 98.9% accuracy. The only variable that was statistically significant in this model using the matched sample was the number of credit hours completed. The beta for credit hour completion was positive indicating that there was a positive relationship between credit hour completion and bachelor's degree attainment. The exponentiated beta (odds ratio) for credit hours was 1.034 indicating that for every single unit increase in the number of credit hours earned, the students were 1.034 times as likely to earn a bachelor's degree. Comparing this result to the results of the same analysis conducted on the non-matched sample, it should be noted that the completion of an associate degree, and the number of developmental education courses completed are no longer significant as they were in the analysis of research question 3b. The only variable that was significant in both the matched and non-matched analysis was the number of credit hours completed. The results of this analysis including the regression coefficients (B), the Wald statistics, the significance level, the odds ratio [$\text{Exp}(B)$], and the 95 percent confidence intervals (CI) for odds ratios (OR) of the analysis are listed in Table 14. These results indicate that in the more rigorous, matched sample design, the number of developmental courses taken was no longer a negatively associated, significant predictor of bachelor's degree attainment as was indicated in Table 11.

Table 14.

Matched Sample Results from Logistic Regression Predicting Whether Developmental Course Completion, Credit Hours Earned, Associate Degree Earned, and Number of Developmental Courses Completed Impacted the Likelihood of Earning a Bachelor's Degree

Step	Variable Entered	<i>B</i>	Wald	Significance	Exp(<i>B</i>)	95% C.I. for Exp(<i>B</i>)	
						<i>Lower</i>	<i>Upper</i>
1	Developmental Course Completion	-.435	.613	.434	.647	.218	1.924
	Credit Hours Earned	.033	15.019	.000	1.034	1.016	1.051
	Associate Degree Earned	-1.058	3.025	.082	.347	.105	1.144
	Number of Dev Courses Completed	-.119	.660	.417	.887	.665	1.184
	Constant	-2.384	41.549	.000	.092		

RQ 4c (Matched sample) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of bachelor's degree attainment after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load? The inclusion of the additional variables yielded a significant model, $X^2(10, N = 222) = 25.100, p < .05$. The Nagelkerke *R* square was .177. This pseudo R^2 indicates that 17.7% of the variance in the dependent variable is explained by the independent variables included in the model. The model was 97.8% accurate in predicting students who would not attain a bachelor's degree, but only 7.7% accurate in predicting students who would attain a bachelor's degree. The overall prediction accuracy of the model was 82%

and only slightly higher than the previous model. The number of credit hours earned is the only statistically significant variable in this logistic regression analysis using the matched sample. The beta for the number of credit hours earned was positive indicating a positive relationship between earned credit hours and bachelor's degree attainment. The exponentiated beta (odds ratio) for credit hours was 1.024 indicating that for every single unit increase in the number of credit hours earned, the students were 1.024 times as likely to earn a bachelor's degree. The other variables that were significant when this same analysis was conducted on the non-matched sample including associate degree completion, and high school GPA were no longer significant. The results of this analysis including the regression coefficients (B), the Wald statistics, the significance level, the odds ratios [$\text{Exp}(B)$], and the 95 percent confidence intervals (CI) for odds ratios (OR) of the analysis are listed in Table 15. These results indicate the number of developmental courses taken is not related to bachelor's degree attainment.

Table 15.

Matched Sample Results from Logistic Regression Predicting Whether Developmental Course Completion, Credit Hours Earned, Associate Degree Earned, Number of Developmental Courses Completed, Age, Gender, Race, Pell status, High School GPA, or Part-time/Fulltime Load Impacted the Likelihood of Earning a Bachelor's Degree

Step	Variable Entered	<i>B</i>	Wald	Significance	Exp(<i>B</i>)	95% C.I. for Exp(<i>B</i>)	
						<i>Lower</i>	<i>Upper</i>
1	Developmental Course Completion	-.572	1.032	.310	.564	.187	1.701
	Credit Hours Earned	.024	6.468	.011	1.024	1.006	1.044
	Associate Degree Earned	-.758	1.474	.225	.468	.138	1.594
	Number of Dev Courses Completed	-.001	.000	.996	.999	.741	1.348
	Age	.033	.134	.714	1.034	.865	1.237
	Gender	-.391	.925	.336	.676	.305	1.501
	Race	.163	.119	.730	1.176	.467	2.961
	Pell status	-.767	3.197	.074	.464	.200	1.077
	High School GPA	.721	3.147	.076	2.057	.927	4.565
	Fulltime/part-time load	.114	.044	.834	1.121	.386	3.258
	Constant	-4.714	4.729	.030	.009		

Transfer to a For-Profit Institution

Research questions five and six focused on examining the predictors that impacted whether students were more or less likely to transfer to a for-profit institution. Research question five focused on the non-matched sample and research question six focused on the same questions

but with similar students who were matched using propensity score matching. The same three models were used to analyze these two questions as were used in the previous analyses.

RQ 5a (Non-matched) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a for-profit institution? The logistic regression conducted on the non-matched sample that included only the developmental course completion variable resulted in a model that was not statistically significant. The results including the regression coefficients (B), the Wald statistics, the significance level, the odds ratios [$\text{Exp}(B)$], and the 95 percent confidence intervals (CI) for odds ratios (OR) of the analysis are listed in Table 16. This indicates that without considering other variables, taking developmental education is not related to transfer to a for-profit institution.

Table 16.

Non-Matched Results from Logistic Regression Predicting Whether Completing a Developmental Course Impacted the Likelihood of Transferring to a For-Profit Institution

Step	Variable Entered	B	Wald	Significance	$\text{Exp}(B)$	95% C.I. for $\text{Exp}(B)$	
						Lower	Upper
1	Developmental Course Completion	.163	.191	.662	1.177	.567	2.442
	Constant	-2.667	66.522	.000	.069		

RQ 5b (Non-matched) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a for-profit institution after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college? The model with the additional factors

included was statistically significant, $X^2(4, N=604) = 28.427, p < .001$. The Nagelkerke R square was .113. The model did not accurately predict the students who would attend a for-profit institution with an accuracy rate of 0%. The students who did not attend a for-profit institution were predicted with 100% accuracy giving the model an overall accuracy of 92.7%. The variables that were determined to be statistically significant in this model were the number of credit hours completed and the number of developmental courses completed. The number of credit hours had a beta value that was negative, and the number of developmental courses had a positive beta. This indicated that there was a negative relationship between the number of credit hours and transferring to a for-profit institution. In other words, as the number of credit hours completed increased, the likelihood of attending a for-profit institution decreased. The positive relationship between the number of developmental courses and attending a for-profit institution indicated that as the number of developmental courses completed increased, the likelihood of attending a for-profit institution also increased. The exponentiated beta (odds ratio) for credit hours was .960 indicating that for every single unit increase in the number of credit hours earned, the students were .960 times as likely to attend a for-profit institution. Conversely, the odds ratio for the number of developmental courses completed was 1.345 indicating that for each unit increase in the number of developmental courses completed, students were 1.345 times as likely to transfer to a for-profit institution. The results of this analysis including the regression coefficients (B), the Wald statistics, the significance level, the odds ratios [$\text{Exp}(B)$], and the 95 percent confidence intervals (CI) for odds ratios (OR) of the analysis are listed in Table 17. This indicates that the more developmental courses students complete, the more likely they are to attend a for-profit institution.

Table 17.

Non-Matched Results from Logistic Regression Predicting Whether Developmental Course Completion, Credit Hours Earned, Associate Degree Earned, and Number of Developmental Courses Completed Impacted the Likelihood of Transferring to a For-Profit Institution

Step	Variable Entered	<i>B</i>	Wald	Significance	Exp(<i>B</i>)	95% C.I. for Exp(<i>B</i>)	
1	Developmental Course Completion	-.113	.057	.811	.893	<i>Lower</i> .355	<i>Upper</i> 2.250
	Credit Hours Earned	-.040	14.665	.000	.960	.941	.980
	Associate Degree Earned	.812	.739	.390	2.253	.353	14.369
	Number of Dev Courses Completed	.297	9.093	.003	1.345	1.109	1.631
	Constant	-1.945	30.789	.000	.143		

RQ 5c (Non-matched) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a for-profit institution after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load? The model used to analyze this question included all ten predictor variables and was statistically significant, $\chi^2(10, N= 604) = 39.894, p < .001$. The Nagelkerke *R* square was .157 indicating that the predictors included in this model predicted 15.7% of the variance in students transferring to a for-profit institution. This model did a poor job of predicting the students that transferred to a for-profit institution with 0% accuracy. It was 100% accurate at predicting those that did not attend a for-profit for a 92.7% overall accuracy.

The variables that had a significant relationship to the likelihood of transferring to a for-profit institution were the number of credit hours earned, the number of developmental education courses completed, and gender. The beta for the number of credit hours completed at the community college was negative. In contrast, the beta for the number of developmental education courses completed was positive. These signs indicated that as the number of credit hours completed increased, the likelihood of attending a for-profit institution decreased and as the number of developmental education courses completed increased, the likelihood of attending a for-profit college or university increased. The exponentiated betas (odds ratios) for these predictors quantify this relationship. The exponentiated beta (odds ratio) for credit hours was .961 indicating that for every single unit increase in the number of credit hours earned, the students were .961 times as likely to attend a for-profit institution. The odds ratio for developmental education courses completed was 1.295 indicating that for every additional developmental education course completed, student were 1.295 times as likely to attend a for-profit institution. The beta for gender was positive. Since male was coded as 0 and female was coded as 1. The positive beta indicated that there was a positive relationship between being female and attending a for-profit college or university. The exponentiated beta (odds ratio) for gender was 2.638 indicating that females were 2.638 times as likely to attend a for-profit institution as males. The results of this analysis including the regression coefficients (B), the Wald statistics, the significance level, the odds ratios [$\text{Exp}(B)$], and the 95 percent confidence intervals (CI) for odds ratios (OR) of the analysis are listed in Table 18. This less rigorous, non-matched model indicates that students who take a higher number of developmental education courses are more likely to transfer from the community college to a for-profit institution.

Table 18.

Non-Matched Results from Logistic Regression Predicting Whether Developmental Course Completion, Credit Hours Earned, Associate Degree Earned, Number of Developmental Courses Completed, Age, Gender, Race, Pell status, High School GPA, or Part-time/Fulltime Load Impacted the Likelihood of Transferring to a For-Profit Institution

Step	Variable Entered	<i>B</i>	Wald	Significance	Exp(<i>B</i>)	95% C.I. for Exp(<i>B</i>)	
						<i>Lower</i>	<i>Upper</i>
1	Developmental Course Completion	-.210	.192	.661	.810	.316	2.077
	Credit Hours Earned	-.040	11.786	.001	.961	.939	.983
	Associate Degree Earned	.719	.577	.447	2.053	.321	13.133
	Number of Dev Courses Completed	.259	6.246	.012	1.295	1.057	1.587
	Age	-.048	.734	.392	.954	.855	1.063
	Gender	.970	6.718	.010	2.638	1.267	5.493
	Race	.443	1.543	.214	1.558	.774	3.134
	Pell status	.142	.170	.680	1.153	.586	2.266
	High School GPA	-.127	.177	.674	.881	.488	1.590
	Fulltime/part-time load	.245	.456	.500	1.278	.627	2.603
	Constant	-1.517	1.041	.308	.219		

RQ 6a (Matched sample) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a for-profit institution? The logistic regression conducted on

the matched sample that included only the developmental education course completion variable resulted in a model that was not statistically significant. The results including the regression coefficients (B), the Wald statistics, the significance level, the odds ratios [$\text{Exp}(B)$], and the 95 percent confidence intervals (CI) for odds ratios (OR) of the analysis are listed in Table 19. This indicates that without considering other variables, taking developmental education is not related to transfer to a for-profit institution.

Table 19.

Matched Sample Results from Logistic Regression Predicting Whether Completing a Developmental Course Impacted the Likelihood of Transferring to a For-Profit Institution

Step	Variable Entered	B	Wald	Significance	$\text{Exp}(B)$	95% C.I. for $\text{Exp}(B)$	
1	Developmental Course Completion	.386	.568	.451	1.471	<i>Lower</i> .539	<i>Upper</i> 4.014
	Constant	-2.698	47.758	.000	.067		

RQ 6b (Matched sample) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a for-profit institution after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college? The model with the additional factors included was not statistically significant. The results including the regression coefficients (B), the Wald statistics, the significance level, the odds ratios [$\text{Exp}(B)$], and the 95 percent confidence intervals (CI) for odds ratios (OR) of the analysis are listed in Table 20. This indicates that the number of developmental education courses taken is not related to transfer to a

for-profit institution. It is of note that in this more rigorous analysis, the number of developmental education courses taken is no longer related to transfer to a for-profit institution as it was in the less rigorous method represented in Table 17.

Table 20.

Matched Sample Results from Logistic Regression Predicting Whether Developmental Course Completion, Credit Hours Earned, Associate Degree Earned, and Number of Developmental Courses Completed Impacted the Likelihood of Transferring to a For-Profit Institution

Step	Variable Entered	<i>B</i>	Wald	Significance	Exp(<i>B</i>)	95% C.I. for Exp(<i>B</i>)	
						<i>Lower</i>	<i>Upper</i>
1	Developmental Course Completion	.956	1.652	.199	2.601	.606	11.171
	Credit Hours Earned	-.025	3.034	.082	.975	.947	1.003
	Associate Degree Earned	.284	.044	.834	1.328	.094	18.804
	Number of Dev Courses Completed	-.061	.073	.788	.941	.605	1.464
	Constant	-2.187	24.728	.000	.112		

RQ 6c (Matched sample) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a for-profit institution after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load? The logistic regression conducted on the matched sample that included all ten predictor variables yielded a model that was not statistically

significant. However, in this model, gender was a statistically significant predictor of the likelihood of attending a for-profit institution. The beta for gender was positive indicating a positive relationship between being a female and attending a for profit college or university. The exponentiated beta (odds ratio) for gender was 3.611 indicating that in the matched sample, females were 3.611 times as likely to attend a for-profit institution as males. The results including the regression coefficients (B), the Wald statistics, the significance level, the odds ratios [$\text{Exp}(B)$], and the 95 percent confidence intervals (CI) for odds ratios (OR) of the analysis are listed in Table 21. This indicates that taking developmental education is not related to transfer to a for-profit institution but being a female is positively related to attending a for-profit institution.

Table 21.

Matched Sample Results from Logistic Regression Predicting Whether Developmental Course Completion, Credit Hours Earned, Associate Degree Earned, Number of Developmental Courses Completed, Age, Gender, Race, Pell status, High School GPA, or Part-time/Fulltime Load Impacted the Likelihood of Transferring to a For-Profit Institution

Step	Variable Entered	<i>B</i>	Wald	Significance	Exp(<i>B</i>)	95% C.I. for Exp(<i>B</i>)	
						<i>Lower</i>	<i>Upper</i>
1	Developmental Course Completion	1.032	1.751	.186	2.808	.608	12.961
	Credit Hours Earned	-.018	1.092	.296	.982	.950	1.016
	Associate Degree Earned	.189	.018	.893	1.208	.078	18.802
	Number of Dev Courses Completed	-.106	.207	.649	.899	.570	1.419
	Age	.045	.207	.649	1.046	.861	1.272
	Gender	1.284	4.084	.043	3.611	1.039	12.542
	Race	.426	.468	.494	1.530	.452	5.180
	Pell status	-.218	.138	.710	.804	.255	2.538
	High School GPA	-.562	1.069	.301	.570	.196	1.655
	Fulltime/part-time load	-.095	.018	.894	.910	.225	3.672
	Constant	-2.372	.886	.346	.093		

Summary

In this chapter, the results of the analysis conducted in this study were presented. The following tables summarize the findings for each outcome. The results for the first outcome of

transfer to a four-year institution are presented in Table 22. As noted in Table 22, the results of the analysis were different depending on whether the sample being examined was the original non-matched sample or the propensity score matched sample. Ultimately, the more rigorous analysis determined that there is a correlation between the number of credit hours completed at the community college and the likelihood of transfer to a four-year institution. As the number of credit hours increased, the likelihood of transferring to a four-year college or university increased. The more rigorous model did not indicate that the number of developmental education courses taken was related to transfer to a four-year institution.

Table 22.

Summary of Results from Analysis of Students Transferring to a Four-Year Institution

Dependent Variable/Outcome	Independent Variables/ Predictors Included	Non-matched Sample N=604 Results	Matched Sample N=222 Results
Transfer to 4-year institution (Model 3)	Dev or Not Dev	Model is significant	Model is significant
	Credit hours earned	More credit hours earned → more likely to transfer to 4 yr.	More credit hours earned → more likely to transfer to 4 yr.
	Earned associate # of Dev	# of dev increases → less likely to transfer to 4 yr.	Note: Number of dev is no longer significant when using the matched sample; race and HS GPA are also no longer significant
	Age	Non-white → more likely to transfer to 4 yr.	
	Gender		
	Race	Higher HS GPA → more likely to transfer to 4 yr.	
	Pell		
	HS GPA		
PT/FT Load			

The second outcome considered in this study was the likelihood of the students earning a bachelor's degree. In Table 23, the results of the analysis of this outcome are noted. Again, the results were notably different according to the sample. In the more rigorous model in which propensity score matching was used, the only significant variable revealed by the study was again the number of credit hours earned at the community college. As the number of credit hours earned increased, the likelihood of completing a bachelor's degree also increased. The more rigorous model, however, did not indicate that the number of developmental education courses completed was related to bachelor's degree attainment.

Table 23.

Summary of Results from Analysis of Students Earning a Bachelor's Degree

Dependent Variable/ Outcome	Independent Variables/ Predictors Included	Non-matched Sample N = 604	Matched Sample N = 222
Graduate with BA or BS (Model 3)	Dev or Not Dev	Model is significant	Model is significant
	Credit hours earned	More credit hours earned → more likely to graduate with BA or BS	More credit hours earned → more likely to graduate with BA or BS
	Earned associate		
	# of Dev		Note: Earning an associate degree is no longer a significant predictor; nor is HS GPA
	Age	Earned associate degree → less likely to graduate with BA or BS	
	Gender		
	Race	Higher HS GPA → more likely to graduate with BA or BS	
	Pell		
	HS GPA		
PT/FT Load			

The third outcome examined in this research was the likelihood of students transferring from the community college to for-profit institutions. The results of this portion of the study are noted in table 24. The more rigorous model using propensity score matching to more closely mimic randomization indicated that being female in this study was a significant predictor of attending a for-profit institution. The study indicated that females were significantly more likely than males to transfer to a for-profit institution. Although the less robust model did indicate that the number of developmental courses taken was positively related to transfer to a for-profit institution, the more robust, propensity-score matched analysis did not.

Table 24.

Summary of Results from Analysis of Students Transferring to For-Profit Institutions

Dependent Variable/ Outcome	Independent Variables/ Predictors Included	Non-matched Sample N=604	Matched Sample N = 222
Attending a for-profit institution (Model 3)	Dev or Not Dev Credit hours earned Earned associate # of Dev Age Gender Race Pell HS GPA PT/FT Load	Model is significant More credit hours earned → less likely to attend for-profit institution # of dev increases → more likely to attend for-profit institution Females are more likely than males to attend a for-profit institution	Model not significant (overall) Females are more likely than males to attend a for-profit institution Note: Credit hours earned, and number of developmental courses are no longer significant as they were in the model prior to propensity score matching.

CHAPTER 5

DISCUSSION

It is common for students to transfer from one college to another. According to the U.S. Department of Education (2017), 23.4% of first-time college students who started college in 2003 attended at least two colleges by 2008. An additional 10.5% of these students attended three or four different colleges in the same time span (U.S. Department of Education, 2014). Many of these first-time freshmen arrive at their inaugural institutions unprepared for the rigors and expectations of college-level work. As noted by American College Testing (2018), only 38% of the students graduating in 2018 met college readiness standards in all areas. Tragically, the news is even worse for underserved populations with less than 25% of minorities, low income, and/or first-generation students meeting the ACT college readiness benchmarks in English, reading, math, and science (American College Testing, 2018).

Many students are graduating from high school unprepared for college-level courses, but these students often hope to attend and aspire to earn bachelor's degrees. According to American College Testing (2018), 70% of the graduating class of 2018 hoped to earn a bachelor's degree or a more advanced degree. There is a disconnect between preparation and aspiration, and the community college is a vital conduit to filling that gap. Developmental education has traditionally been the access point to the community college for many of these underprepared students. In fact, as noted by Complete College America (n.d.), 52% of first-time two-year college students nationally enrolled in developmental math, and 34% of these students enrolled in developmental English. The proportions are even higher for African American students with 61% starting their academic pursuits in developmental math and 49% beginning college with developmental English.

This research examined the long-term effect of starting in developmental education on this group of students by examining three outcomes. The first research question focused on the factors that impacted the likelihood of students transferring to a four-year institution. The second research question examined whether students went on to accomplish their academic goal of earning a bachelor's degree and the third considered whether certain students were more likely to attend a for-profit institution after leaving the community college. In this chapter, the conclusions of this study will be discussed and recommendations for practitioners and leaders will be addressed.

Purpose Statement and Research Questions

The purpose of this study was to compare transfer and bachelor's degree attainment outcomes of students who took developmental education courses at a community college with those who did not take developmental courses. The study also examined whether completing developmental education courses increased the likelihood of a student attending a for-profit institution.

The research conducted in this study focused on the following questions:

- 1) a) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a four-year college or university?
- b) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a four-year college or university after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college?

- c) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a four-year college or university after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load?
- 2) a) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a four-year college or university?
- b) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a four-year college or university after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college?
- c) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a four-year college or university after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load?
- 3) a) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of bachelor's degree attainment?

- b) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of bachelor's degree attainment after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college?
 - c) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of bachelor's degree attainment after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load?
- 4) a) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of bachelor's degree attainment?
- b) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of bachelor's degree attainment after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college?
 - c) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of bachelor's degree attainment after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree

attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load?

- 5) a) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a for-profit institution?
 - b) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a for-profit institution after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree attainment at the community college?
 - c) To what extent do students who complete at least one developmental course differ from students who do not complete any developmental courses in terms of transfer to a for-profit institution after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load?
- 6) a) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a for-profit institution?
 - b) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a for-profit institution after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, and associate degree

attainment at the community college?

- c) To what extent do students who complete at least one developmental course differ from similar students who do not complete any developmental courses in terms of transfer to a for-profit institution after controlling for credit hours earned at the community college, number of developmental courses completed with a C or better, associate degree attainment at the community college, age, gender, race, Pell status, high school GPA, and part-time/fulltime load?

Transfer to a Four-Year Institution

The results varied based on the methodology employed and the variables included as predictors for determining the likelihood that students would transfer to four-year institutions. The use of a non-matched sample is the most commonly used methodological approach in this type of study; however, this method is correlational and does not control for alternate explanations of the results. Therefore, non-matched models would be expected to mimic what is already known from the literature. The results and conclusions of the two samples, non-matched and matched, are summarized below.

Conclusions based on non-matched models. In the model that controlled for all ten predictor variables and also employed methodology that did not include any matching techniques, the results indicated that there were four statistically significant predictors of the likelihood that students would transfer to a four-year institution. The significant variables and the conclusions drawn from them are listed below:

- 1) The more credit hours students earned at the community college, the more likely they were to transfer to four-year institutions.

- 2) The more developmental education courses students completed, the less likely they were to transfer to four-year institutions.
- 3) Non-white students were more likely to transfer to four-year institutions than white students.
- 4) Students with higher GPAs from high school were more likely to transfer to four-year institutions.

Based on these results, community college leaders and practitioners would conclude that encouraging students to complete as many credits as possible as quickly as possible would be in the best interest of students who planned to transfer to four-year institutions. They would also conclude that the fewer developmental education courses students complete, the stronger their odds would be of transferring to a four-year college or university. This result is consistent with developmental education research and feeds into the current trends across the nation of limiting, accelerating, or eliminating developmental education. The result regarding non-white students being more likely to transfer to four-year institutions was perplexing and ran counter to most other research studies. However, Wood and Palmer (2016) did find in their correlational study using national data from the Community College Survey of Student Engagement that black males who intended to transfer to a four-year institution were more likely to have taken developmental education. It is also notable that in Wood and Palmer's (2016) study, as in the current study, the majority of the students in the sample (63%) took developmental education. Finally, the results regarding high school GPA were consistent with other correlational studies such as Bahr et al. (2019) who found that high school GPA was the most reliable predictor of community college students' performance in math and English. This research would potentially encourage leaders to consider high school GPA in placement decisions.

Conclusions based on matched models. In the more robust, propensity score matched model in which matching was used to more closely mimic a randomized sample, only one variable was shown to be a statistically significant predictor of whether students transferred to four-year institutions. The significant variable and the conclusions drawn from it are listed below:

- 1) The more credit hours students earned at the community college, the more likely they were to transfer to four-year institutions.

Based on these results, community college leaders and practitioners may reach different conclusions than those reached in the less rigorous model noted above. In the propensity score matched model, students were matched based on six variables: age, gender, race, Pell status, high school GPA, and part-time/fulltime load. Each student who completed one or more developmental education course was matched with a similar student who did not complete any developmental education courses. Under these conditions, the only significant factor in transfer to a four-year institution was the number of credit hours completed.

In the more rigorous model, the number of developmental education courses completed was not a significant predictor of transfer to a four-year college or university. This indicated that if students were matched with other students with similar demographic backgrounds and first semester load levels that the number of developmental courses completed was not a significant factor in predicting their subsequent transfer to a four-year institution. There was a negative relationship between the number of developmental courses completed and transfer to a four-year institution, but it was not statistically significant. The only significant factor was the number of credits earned. This result would encourage practitioners such as academic advisors to encourage students to complete as many credits as possible as quickly as feasible at the

community college. The results regarding developmental education ran counter to much of the research available on the subject including Crisp and Delgado (2014) who found in their propensity score matched study that developmental education courses had a negative impact on community college students' likelihood of transferring to a four-year college or university. Crisp and Delgado (2014) used a national dataset. The current study was conducted at a single institution and may indicate that developmental education is successful at some institutions in leveling the playing field for academically underprepared students. The fact that there were students who took developmental education who were able to be matched with students who did not take developmental education across the GPA spectrum is disturbing and may indicate that there were issues with placement using a single placement test as was the practice at this college during the time of this study. These issues will be discussed further in an upcoming section.

Bachelor's Degree Attainment

The results varied depending on the methodology used to examine the likelihood of students attaining a bachelor's degree. The predictor variables that were significantly related to attaining a bachelor's degree were quite different depending upon whether propensity score matching was used, or the sample examined was non-matched. The results and conclusions of the two methods are presented below.

Conclusions based on non-matched models. Model two included the following independent variables: whether students completed one or more developmental course, the number of credit hours earned, associate degree attainment, and the number of developmental education course. The results indicated that the number of developmental courses completed was a significant factor in predicting the likelihood of attaining a bachelor's degree. When the demographic and socioeconomic characteristics of age, gender, race, Pell status, high school

GPA, and part-time/fulltime load were added in model three, the number of developmental courses was no longer a significant predictor of the likelihood that students would complete a bachelor's degree. The significant variables and the conclusions drawn from both models are listed below.

The significant predictor variables resulting from the logistic regression using developmental or not developmental, credit hours earned, associate degree earned, and the number of developmental courses as the independent variables with the non-matched sample are listed below:

- 1) The more credit hours students earned at the community college, the more likely they were to attain a bachelor's degree.
- 2) Students who earned associate degrees at the community college were less likely to attain a bachelor's degree.
- 3) The more developmental education courses students completed, the less likely they were to attain a bachelor's degree.

These results would lead practitioners and administrators at community colleges to encourage students to take 15 credit hours per semester. It would also seem from this result that earning an associate degree was not desirable for students who wished to attain a bachelor's degree. This, however, was a result that was more reflective of a limitation of this study than an actionable conclusion because the associate degree completion data were not limited to only those that earned a degree intended for transfer. This dataset also included those who graduated with applied degrees such as nursing or machine tool technology. These students would logically not plan to move forward to earn a bachelor's degree. This fact helped explain this data point. The other conclusion that community college faculty and staff would reach based on this model's

results would be that the less developmental courses a student takes, the better. The results of model three which included students' demographic and socioeconomic factors was different and is listed below:

This model added age, gender, race, Pell status, high school GPA, and part-time/fulltime load to the predictor variables included in model two. The results and conclusions based on the logistic regression with a non-matched sample are listed below:

- 1) The more credit hours students earned at the community college, the more likely they were to attain a bachelor's degree.
- 2) Students who earned associate degrees at the community college were less likely to attain a bachelor's degree.
- 3) Students with higher GPAs from high school were more likely to attain a bachelor's degree.

Most notably when additional demographic and socioeconomic variables were added to the model, the number of developmental courses completed was no longer a significant predictor of the likelihood of students graduating with their bachelor's degree. This indicated that when the demographic and socioeconomic variables were controlled for, the number of developmental courses completed was no longer a significant predictor of a student's long-term odds of completing a bachelor's degree. Again, this result ran counter to much of the research that has been touted in the calls for the elimination or overhaul of developmental education.

Conclusions based on matched models. Models two and three were consistent in the results found using the propensity score matched sample. The only significant predictor variable found in both of these more robust models was the number of credit hours earned. The significant predictor variable and the conclusions drawn from it are listed below:

- 1) The more credit hours students earned at the community college, the more likely they were to attain a bachelor's degree.

Based on this more rigorous model using propensity score matching to more closely mimic a randomized sample, practitioners and leaders would again reach different conclusions regarding actionable steps to take using these data. Again, advisors would be encouraged to enroll students in a full load each semester and encourage students to remain at the community college to complete as many credits as they could before transferring to a four-year institution. The data do not, however, identify the number of credits of developmental courses that students take as a significant factor in whether they move on to graduate with a bachelor's degree. This research indicated that persisting and finishing a higher number of credit hours at the community college was the key to future bachelor's degree attainment regardless of whether students took developmental education or not.

Transfer to a For-Profit Institution

In the current study, results varied based on the methodology employed and the variables included as predictors for determining the likelihood that students would transfer to a for-profit institution. The results and conclusions of the two samples, non-matched and matched, are presented below.

Conclusions based on non-matched models. In the model that controlled for all ten predictor variables and also employed methodology that did not include any matching techniques, the results indicated that there were three significant predictors of students transferring to for-profit institutions. The significant variables and the conclusions drawn from them are listed below:

- 1) The more credit hours students earned at the community college, the less likely they were to transfer to a for-profit institution.
- 2) The more developmental education courses students completed, the more likely they were to transfer to a for-profit institution.
- 3) Females were more likely than males to attend a for-profit institution.

Using these results, community college leaders and practitioners would conclude that earning more credit hours decreased the likelihood of students attending for-profit institutions. They might also conclude that students who took multiple developmental education courses were more likely to attend for-profit institutions. Unfortunately, these results also showed that females are more vulnerable to the lure of for-profit institutions.

Conclusions based on matched models. In the more robust, propensity score matched model in which matching was used to more closely mimic a randomized sample, the overall model was not significant. However, there was one variable shown to be a statistically significant predictor of whether students transferred to for-profit institutions. The significant variable and the conclusions drawn from it are listed below:

- 1) Females were more likely than males to attend a for-profit institution.

Notably, in the more rigorous model, the number of credit hours was no longer found to be a shield against students attending for-profit institutions. Also, the number of developmental courses taken was no longer found to be a significant predictor of transfer to for-profit institutions. Infuriatingly, the only predictor that was shown to be a significant indicator of attending a for-profit institution was being a female. Although this was a disturbing result, it was not surprising based on other research studies about the predatory behavior of for-profit recruiters toward female students particularly single mothers with low income (Appel & Taylor,

2015). These conclusions regarding for-profit attendance need to be considered, however, within the context of the study. The study only included one community college with a relatively small sample size, and the percentage of students who actually attended a for-profit institution was small. Therefore, these results may be unique to this particular college and cannot be generalized to the larger population.

Summary of Findings and Conclusions

The most prominent result in this study was that the number of credit hours a student completes at the community college matters. The more credit hours the student earns, the better. In no case where the more rigorous propensity-score matching methodology was used were the number of developmental education courses shown to be a statistically significant factor predicting one of the studied outcomes. In each of the less robust models, where no matching techniques were employed, the number of developmental courses taken was shown to be a significant predictor of negative results in at least one of the models. In this particular study, if the researcher had not employed more rigorous statistical techniques, the results would have pointed squarely at developmental education as a negative predictor of transfer to a four-year institution and of bachelor's degree attainment. The researcher would have also concluded that developmental education was a positive predictor of future attendance at a for-profit institution. These disparate results plead for the need for academic researchers to strive for more rigorous methodologies when studying developmental education and its long-term outcomes. Perhaps it would be found that developmental education has been unfairly maligned. It could also validate previous research and strengthen conclusions. The answer to this will not be known until the research is completed. In the "first wave" of the research on developmental education focused

on short term outcomes and used a regression discontinuity approach (Jaggars & Bickerstaff, 2018).

Findings Related to the Literature

The results of this study supplement the research that has been conducted on developmental education and vertical transfer. A multitude of studies have focused on either of these subjects, but fewer have linked the two aspects together – especially at individual institutions. The current research helps fill that gap.

Mourad and Hong (2011) completed research very similar to the current study. They studied the factors that contributed to bachelor's degree completion by students who transferred vertically. Similar to the current study, Mourad and Hong (2011) conducted a logistic regression but unlike the current study, they did not use any matching techniques. Their research was also similar to the current study in the fact that Mourad and Hong (2011) followed the students in the sample for an eight-year timespan. Mourad and Hong's (2011) research was also relevant to the current research because the researchers conducted their study using data from a single institution rather than a national dataset. Much of the other research linking developmental education and vertical transfer outcomes was conducted using a national dataset (Crisp & Delgado, 2014; Crisp & Nora, 2010; Monaghan & Attewell, 2015).

Mourad and Hong (2011) used information from National Student Clearinghouse to obtain data on the students' bachelor's degree attainment information as did the current study. Notably, Mourad and Hong (2011) found, as in the current research, earning more credits at the community college increased students' likelihood of attaining a bachelor's degree. Similar to the

current study's findings using the propensity-score matched sample, Mourad and Hong (2011) did not find that taking or not taking developmental courses was a significant factor in bachelor's degree attainment. In contrast, Crisp and Delgado (2014) found developmental education courses decreased the likelihood of students successfully transferring vertically. The researchers used propensity score matching and linear modeling to conduct their study on a national dataset (Crisp & Delgado, 2014).

Implications for Policy and Practice

The results of this study can be utilized by both community college practitioners and leaders. The most prominent utility for this research is in the area of advisement. This study also has implications for placement policy, developmental education reforms, and transfer pathways from two-year to four-year institutions.

Advisement for transfer students. The advisement of transfer students can be very difficult. In the state where this research took place, there are system-wide articulation agreements with specific colleges or universities, but these agreements vary from institution to institution. Every student has to be advised differently according to which transfer institution and program of study he or she selects. A statewide list of universally transferable courses is available, but inclusion on this list does not guarantee the course will transfer directly into the student's chosen major at their selected institution. Each course at the community college has to be painstakingly matched with a course in the student's chosen program at the four-year institution.

This process is very cumbersome, confusing, and time-consuming for both advisors and students. The results found in this study indicated that the more credits students earned at the community college, the more likely they were to transfer to a four-year college or university and

to graduate with a bachelor's degree. The results of this study suggest that leaders of advisement initiatives should encourage advisors to guide students to earn as many credits as possible at the community college prior to transferring to their four-year college or university.

Transfer pathways and articulations. As reflected above, advisement and student success pathways are closely linked, but convoluted. The advisement process for advisors and students would be much easier if statewide policy encouraged the creation of meta-majors and incentivized the completion of the university transfer associate degrees as a required step in the pathway to a bachelor's degree. If policy makers mandated that upon completion of their university transfer associate degrees, students were automatically granted junior status at their transfer institution with guaranteed completion of their general education core, many of the obstacles for transferring students would be removed. Streamlining the vertical transfer pathway from community college to four-year institution would minimize the plethora of programs that advisors currently need to research and provide a straightforward pathway for students to follow while earning the ultimate number of credits. It would also prevent credit loss which is a major deterrent for community college students in completing their bachelor's degree.

Placement policy. At the time that the students in this research sample entered the community college, the only means of placement was a single placement test. The fact that the researcher was able to build a propensity score matched sample at all is concerning. If placement policy was ideal, there would not be a matched group to find. In the entire matched dataset, the mean high school GPA was 3.0272; and the range was from 1.21 to 4.75. Splitting the file into two groups, the non-developmental education group and the developmental education group revealed an even more stark situation. The mean high school GPA for the non-developmental group was 3.0102, however the mean high school GPA for the developmental

group was incongruently higher at 3.0442. This is a small difference; however, it would be anticipated that the high school GPA for the non-developmental group would be higher. This high school GPA information is indicative of the fact that the placement test alone was not doing a satisfactory job of placing students into developmental education courses.

Thankfully, since the time of this research, the researched community college has changed its placement policies and is now using multiple measures including high school GPA and select high school course grades to place students. The college no longer uses one test to determine whether students are curriculum ready. In a study using a survey instrument, Fields and Parsad (2012) found that only 8% of public, two-year institutions were using high school GPA for placement in math. This research serves as a call to any two-year institution that is still using a single placement test to place students to abandon this practice and adopt a multiple measures approach that includes high school GPA.

Developmental education reforms. Developmental education has gone through multiple reforms and served as a convenient scapegoat for low completion rates at community college for the last decade or more. The more rigorous, propensity score matched results found in this study indicated that when demographic, socioeconomic, and course load variables were used to match students and closely mimic a randomized sample, the number of developmental education courses was not a significant determinant of transfer to a four-year institution or of attaining a bachelor's degree. Developmental education was also found not to be a predictor of student transfer to a for-profit institution.

The results of this research suggest that community college leaders and state policy makers should use caution when mandating developmental education reforms. It is clearly not a one size fits all situation. Institutional leaders and state legislators should conduct rigorous

research at their local institutions to study the long-term impact of developmental education programs. They should also know that the goal of developmental education is to level the playing field for underprepared students, not to take students who are academically deficient and catapult them to higher achievement than their more academically prepared peers. Using a standard that implies that after one semester of remediation, developmental education students should do better than their peers who came into college with more preparation is putting developmental education in a no-win situation. The standard was intended to be that students who take developmental education go on to do just as well as their more academically prepared peers. This is a fair standard with which to judge developmental programs.

Finally, the results of this study suggest that the more credits a student earns, the higher the likelihood of attaining a bachelor's degree. This lends credence to developmental education reforms which encourage acceleration of the developmental sequence such as compressed and co-requisite models (Jaggars & Bickerstaff, 2018). This acceleration will potentially help students earn more credits faster which, according to this research, should reap long-term benefits for students including improved odds of earning a bachelor's degree. To recap, this study suggests that community college leaders, state lawmakers, and practitioners consider four actions regarding developmental education policy and practice:

- Be cautious of mandating one size fits all policies to developmental education programs at both the institutional and state level.
- Encourage and incentivize vigorous research to determine the longitudinal impact of developmental education programs.
- Reconsider the lens through which the success of developmental education is viewed – the standard was intended to be that developmental education programs create a level

playing field. The intent of developmental education is not to make developmental students higher achieving than their more academically prepared peers. This would be an excellent aspiration, but it is not the reality that developmental educators face, yet it is the standard that much of the research on developmental education demands. This is not a reasonable metric.

- Encourage developmental education practitioners at local institutions to explore ways to accelerate the developmental education sequence.

Recommendations for Future Research

The results of this study reveal opportunities for future research. First, the study could be replicated with data from the entire system of technical/community colleges in the state where the research was conducted. This would provide a larger sample size and afford state educational leaders the opportunity to examine the long-term outcomes of students who enter college with the intent of earning a bachelor's degree. A study conducted with a larger sample size could also confirm or contradict the finding that females are more likely to attend for-profit institutions. If broken down by individual college, it would also give institution leaders actionable information. This research could serve as an impetus for state leaders to create more streamlined, articulated pathways for students who transfer from community college to a four-year college or university.

Second, future research could be conducted by dividing the number of credit hours into groups, similar to the research conducted by Monaghan and Attewell (2015), so that the threshold at which students improve their chances of bachelor's degree attainment could be determined. For example, the research could indicate that 45 credit hours or more is the level at which students truly begin to significantly increase their likelihood of transfer success. Third,

the current study could be replicated at the same college after multiple measures of placement were implemented. It would be interesting to determine if similar results would be obtained now that high school GPA is a determining factor in student placement.

Fourth, the current study could be conducted using multiple timeframes such as four years, six years, and eight years to determine the length of time that students require to complete their bachelor's degree. Finally, similar research could be conducted with a focus on students' vertical transfer success at different institutions as was done by Mourad and Hong (2011).

Conclusions

Developmental education and vertical transfer have been and continue to be very relevant topics for educational leaders and practitioners. Many students begin their college experience at two-year institutions. A multitude of these students enter their first college classrooms taking one or more developmental courses. A majority of these students leave high school aspiring to earn a bachelor's degree, and community colleges provide their only means of reaching this goal. However, too few students, whether they take developmental courses or not, are accomplishing this dream. Increasingly in today's rapidly changing economy, a bachelor's degree is often the gateway to upward social mobility. For these reasons, it is imperative that higher education leaders realize the importance of increasing the success the pathway from developmental education to bachelor's degree attainment.

The results of this study indicate that students who persist through the developmental education sequence and earn a substantial number of college credits have outcomes that are similar to their peers who did not take developmental education. The most notable results in this study suggest that students who take more credits at the community college prior to transfer have an increased likelihood of obtaining a bachelor's degree. These results indicate that higher

education leaders would improve students' chances of obtaining a bachelor's degree by accelerating or shortening developmental education pathways and streamlining the associate degree curricula through the creation of meta-majors that transfer seamlessly to partner four-year institutions. College and state leaders would also benefit students by incentivizing associate degree completion at the community college thus assuring that students complete the maximum number of credits prior to transfer.

One of the noted aspects of this research was the fact that the creation of a matched group of students was possible. The high school GPA ranges of this matched group suggested that the placement processes in place at the time of this research were less than optimal. This aspect of the study indicates that community college leaders consider moving away from a single placement test as their institutions only means of placement and include multiple measures of assessment including high school GPA in placement decisions. Finally, the findings of this study suggest that college leaders should incentivize and support rigorous institutional research that measures the long-term impact of developmental education on student outcomes such as bachelor's degree attainment.

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APPENDICES

APPENDIX A: HUMAN SUBJECTS EXEMPT RESEARCH LETTER



OFFICE OF THE VICE PRESIDENT FOR RESEARCH



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Phone(757) 683-3460
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DATE: February 8, 2018

TO: Shana Pribesh

FROM: Old Dominion University Education Human Subjects Review Committee

PROJECT TITLE: [1194363-1] Community College Transfer with Developmental Education

REFERENCE #:

SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF EXEMPT STATUS

DECISION DATE: February 8, 2018

REVIEW CATEGORY: Exemption category # 6.4

Thank you for your submission of New Project materials for this project. The Old Dominion University Education Human Subjects Review Committee has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

We will retain a copy of this correspondence within our records.

If you have any questions, please contact Jill Stefaniak at (757) 683-6696 or jstefani@odu.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within Old Dominion University Education Human Subjects Review Committee's records.

**APPENDIX B: SUMMARY OF RESULTS FROM ANALYSIS OF STUDENTS
TRANSFERRING TO A FOUR-YEAR INSTITUTION**

Dependent Variable/Outcome	Independent Variables/ Predictors Included	Non-matched Sample N=604 Results	Matched Sample N=222 Results
Transfer to 4-year institution (Model 1)	Dev or Not Dev	Model not significant	Model not significant
Transfer to 4-year institution (Model 2)	Dev or Not Dev	Model is significant	Model is significant
	Credit hours earned	More credit hours earned → more likely to transfer to 4 yr.	More credit hours earned → more likely to transfer to 4 yr.
	Earned associate		
	# of Dev	# of dev increases → less likely to transfer to 4 yr.	Note: Number of dev is no longer significant when the groups are matched
Transfer to 4-year institution (Model 3)	Dev or Not Dev	Model is significant	Model is significant
	Credit hours earned	More credit hours earned → more likely to transfer to 4 yr.	More credit hours earned → more likely to transfer to 4 yr.
	Earned associate		
	# of Dev	# of dev increases → less likely to transfer to 4 yr.	Note: Number of dev is no longer significant when using the matched sample; race and HS GPA are also no longer significant
	Age		
	Gender	Non-white → more likely to transfer to 4 yr.	
	Race		
	Pell	Higher HS GPA → more likely to transfer to 4 yr.	
HS GPA			
	PT/FT Load		

**APPENDIX C: SUMMARY OF RESULTS FROM ANALYSIS OF STUDENTS
ATTAINING A BACHELOR'S DEGREE**

Dependent Variable/ Outcome	Independent Variables/ Predictors Included	Non-matched Sample N = 604	Matched Sample N = 222
Earn bachelor's degree (Model 1)	Dev or Not Dev	Model not significant	Model not significant
Earn bachelor's degree (Model 2)	Dev or Not Dev Credit hours earned Earned associate # of Dev	Model is significant More credit hours earned → more likely to graduate with BA or BS Earned associate degree → less likely to graduate with BA or BS # of dev increases → less likely to graduate with BA or BS	Model is significant More credit hours earned → more likely to graduate with BA or BS Note: Number of dev is no longer significant when the groups are matched on their entering demographic and socioeconomic variables including FT/PT load; earning an associate degree is also no longer negatively associated with earning a bachelor's degree
Graduate with BA or BS (Model 3)	Dev or Not Dev Credit hours earned Earned associate # of Dev Age Gender Race Pell HS GPA PT/FT Load	Model is significant More credit hours earned → more likely to graduate with BA or BS Earned associate degree → less likely to graduate with BA or BS Higher HS GPA → more likely to graduate with BA or BS	Model is significant More credit hours earned → more likely to graduate with BA or BS Note: Earning an associate degree is no longer a significant predictor; nor is HS GPA

**APPENDIX D: SUMMARY OF RESULTS FROM ANALYSIS OF STUDENTS
TRANSFERRING TO FOR-PROFIT INSTITUTIONS**

Dependent Variable/ Outcome	Independent Variables/ Predictors Included	Non-matched Sample N=604	Matched Sample N = 222
Attending a for-profit institution (Model 1)	Dev or Not Dev	Model not significant	Model not significant
Attending a for-profit institution (Model 2)	Dev or Not Dev Credit hours earned Earned associate # of Dev	Model is significant More credit hours earned → less likely to attend for-profit institution # of dev increases → more likely to attend for-profit institution	Model not significant No significant predictor variables Note: Credit hours earned, and number of dev are no longer significant as they were in the model prior to implementing the propensity score matching techniques.
Attending a for-profit institution (Model 3)	Dev or Not Dev Credit hours earned Earned associate # of Dev Age Gender Race Pell HS GPA PT/FT Load	Model is significant More credit hours earned → less likely to attend for-profit institution # of dev increases → more likely to attend for-profit institution Females are more likely than males to attend a for-profit institution	Model not significant (overall) Females are more likely than males to attend a for-profit institution Note: Credit hours earned, and number of developmental courses are no longer significant as they were in the model prior to propensity score matching.

VITA

Kathryn Mahaffey Harvey

Education:

Ph.D. Candidate – Community College Leadership, Old Dominion University (2018)

M.Ed. Secondary Education – Mathematics, Converse College (1996)

B.S. Business Administration, Concentration in Economics and Finance, University of South Carolina – Upstate (1990)

A.S. University Transfer, Greenville Technical College (1988)

Work Experience:

Associate Vice President of Instruction – Academic Affairs, Spartanburg Community College (October 7, 2019 to present)

Dean – Arts and Sciences Division, Spartanburg Community College (September 1, 2013 to October 6, 2019)

- Chaired the Multiple Measure Work team and played a key role in planning and implementing multiple measures of placement
- Led the revision of General Education assessment
- Played a lead role on the QEP Leadership team
- Coordinated and led the creation and update of the credentialing roster for SACS COC
- Manage approximately \$2M budget
- Assisted with the development of the new Sustainable Agriculture program
- Assisted with the creation of an Art Lab in room B-17 of the Powers Building
- Worked closely with the Director of Admissions and Advising Services to establish method to establish “advising tracks” for students in the pre-health sciences AS degree and students interested in education careers (also used to assign the correct advisor)
- Worked closely with the Director of Admissions and Advising Services to establish and implement ACCUPLACER score ranges
- Worked closely with the Director of Admissions and Advising Services and IT to establish method to record transfer coursework as NC credit; same process has been used to record HS GPA as NC credit
- Designed Viking Early College curriculum and served as liaison between Academic Affairs and VEC
- Designed Spartanburg County Early College High School curriculum and served as liaison between Academic Affairs and SCECHS
- Led the revision of the General Education assessment plan and used this infrastructure as the scaffolding for assessment of the QEP information literacy outcomes

- Planned and implemented training for all faculty and staff on the Self-Service Student Planning advising system
- Spearheaded the inclusion of COL 101/103 in all academic programs

Department Chair – Transitional Studies (Developmental Education) Department, Spartanburg Community College (2000-2013)

Instructor – Transitional Studies (Developmental Mathematics, Spartanburg Community College (1995-2000)

Adjunct faculty; lab assistant; tutor – Transitional Studies and Success Network, Spartanburg Community College (1990-1995)

Memberships/Major Committees:

- South Carolina Technical Education Association
- South Carolina Developmental Education Peer Group (Developmental Math Group Facilitator) (2013)
- South Carolina Association of Developmental Educators – President (2006-2007)
- South Carolina Association of Developmental Educators – President elect and conference chair for SCADE Conference “Technology and Tradition – Balancing the Mix in 2006”, Charleston, SC (November 6, 2006)

On-Campus Committees:

- Arts and Sciences Advisory Committee (2013 – present)
- SCC Early College Advisory Council (2014 – present)
- Extended Executive Council (2014 – present)
- General Education Assessment Committee Chair (2013 – present)
- Registration Committee (2013 – present)
- Graduation Committee (2013 – present)
- Horticulture Advisory Committee (2013 – present)
- Early Care and Education Advisory Committee (2013 – present)
- Viking Early College Implementation Team (2013)
- Calendar Committee chair (2012-2014)
- Cherokee County Stackable Certificates State Model Team (2011 – 2013)
- Faculty Assignment Contract Committee – Pilot Group Leader (2012)
- SACS Fifth Year Interim Report – Chair (2011)

Honors and Awards:

- SCTEA Educator of the Year – Administrator Category – SCC (2017)
- A. Wade Martin Award – SCC Nominee (2012)
- Governor’s Professor of the Year – SCC Nominee (2010)
- SCTEA Educator of the Year – Faculty Category – SCC (2006-2007)