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The Relationship Between Course Delivery Mode and Location with Course Success for Dual Enrolled Students

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with Course Success for Dual Enrolled Students

by

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Abstract

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High school dual enrollment has increased dramatically in recent years, growing 75% nationally between academic years 2002-03 and 2010-11 (Borden, Taylor, Park, & Seiler, 2013). Proponents of dual enrollment programs cite long-term, positive student outcomes for dual enrollment students: higher GPAs in college as adults (Allen & Dadgar, 2012; Jones, 2014; Karp, Calcagno, Hughes, Jeong, & Bailey, 2007), higher first year persistence rates in college (Jones, 2014; Karp et al., 2007), faster time to degree completion (Allen & Dadgar, 2012; Ganzert, 2014; Hughes, 2016), and higher college graduation rates (Ganzert, 2014; Hughes, 2016). However, very little research has focused on short-term success for dual enrolled students.

Course grades earned in dual enrollment programs become a part of the student's official college transcript. As such, these grades can impact a student's ability to be accepted at post-secondary institutions after graduation from high school. In addition, poor grades in dual enrollment courses can negatively affect satisfactory academic progress standards, thus impacting financial aid eligibility as an adult. Therefore, it is important to understand any factors which might improve the chances of student course-level success.

This causal comparative study used *ex post facto* data from four community colleges to examine the correlation between course delivery location (high school or

college campus) for college classes taken by dual enrolled students to student success as defined by final grades in those courses. In addition, this study examined the correlation between course delivery mode (face-to-face, hybrid, or online) for college classes taken by dual enrolled students to student success as defined by final grades in those courses.

The study findings indicated dual enrolled students taking classes on high school sites had higher course grades compared to dual enrolled students taking classes on a college campus. A subset model utilizing data from just one college, however, indicated the opposite. The results also indicated that dual enrolled students taking classes delivered in face-to-face and hybrid modes had higher course grades compared to dual enrolled students taking classes delivered in a fully internet mode. Again, a subset model utilizing data from just one college indicated the opposite.

Dedication

To my mother, Frances, who was ever my most ardent supporter.

And to my son, Connor, without whose maturity and self-reliance these past few years, the time required for the Ph.D. program would not have been possible.

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the value of a strong work ethic and the importance of family. Lastly, thank you to my son, Connor, for your support and unwavering confidence that I can achieve anything I set out to do. It is my hope that this accomplishment helps foster that same level of confidence within you to dream big and make it happen.

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Introduction

State and local appropriations for public higher education funding continually declined across most of the nation between 2000 and 2010 (Kirshstein & Hurlburt, 2012). In discussions of how to address the impact of such budget reductions, Johnstone (2011) argued for increasing the productivity of higher education using several strategies, including a need to "maximize the potential of college-level learning during the high school years" (p. 337). Dual enrollment models may be helping to achieve this goal.

Dual enrollment programs are partnership agreements between secondary and postsecondary institutions which allow high school students to enroll in college courses taught by college instructors for college credit prior to graduating high school (Zinth, 2016). The push for increased democratization of higher education in the United States coupled with the rising costs of college has led many institutions to turn to dual enrollment models as a means to increase access to college for students (Roughton, 2016). For secondary institutions, dual enrollment programs represent a way for high school students to get a head start on the college experience and earn college credits tuition-free or at a reduced cost, depending on individual state policies. In addition, Davis Jenkins, senior research associate at the Community College Research Center at Teachers College of Columbia University, has noted that colleges often use dual enrolled students to help make up for declines in adult enrollment (as cited in Smith, 2017). For all these reasons, secondary and post-secondary institutions have actively worked to increase dual enrollment programs. In fact, 82% of public high schools now offer some type of dual enrollment programs to their students (Thomas, Marken, Gray & Lewis, 2013).

In addition to increasing access to college, dual enrollment programs have been associated with various forms of academic success. The benefits of prior participation in dual enrollment programs for students matriculating as adults have been well documented (Allen & Dadgar, 2012; Ganzert, 2014; Hughes, 2016; Jones, 2014; Karp, Calcagno, Hughes, Jeong, & Bailey, 2007; Karp, Hughes, & Cormier, 2012). However, the literature informing dual enrollment practices is still relatively new. Most studies have not examined the underlying mechanisms impacting the relationship between dual enrollment participation and academic success. Course level success is certainly important to future academic success. Research has shown high school GPA to be a significant predictor of college success (Belfield & Crosta, 2012; Bracco et al., 2014; Scott-Clayton, 2012), and college courses taken while in high school become a part of the student's GPA. Yet, gaps exist in the literature regarding course level success for dual enrollment populations. The intent of this study is to examine two such gaps: the relationships between college course delivery mode (face-to-face, hybrid, or online) and location (community college or high school campus) with course success for dual enrolled students.

Benefits

Much research has correlated participation in high school dual enrollment programs with increased academic success as defined by several different outcomes. Students with prior experience in dual enrollment programs have demonstrated higher GPA's upon matriculating to college as adults (Allen & Dadgar, 2012; Karp et al., 2007). In addition, first-year college persistence rates are higher for students with dual enrollment experience (Jones, 2014; Karp et al., 2007). Students with college credits

accrued from dual enrollment programs also see faster time to degree completion at the college level (Allen & Dadgar, 2012; Ganzert, 2014; Hughes, 2016). Finally, students graduate from college at higher rates if they had prior experience with dual enrollment than if they had no prior experience (Ganzert, 2014; Hughes, 2016).

College and university students in North Carolina with prior dual enrollment participation saw similar results. For example, in a study of one North Carolina dual enrollment program, students who took no dual enrollment courses in high school averaged a 1.63 first-year GPA while students who took six or more dual enrollment courses averaged a 2.08 first-year GPA (Ganzert, 2014).

Literature Gaps

Despite the numerous studies examining academic success of dual enrolled students, two noticeable gaps exist in the literature surrounding dual enrollment efficacy: course delivery mode and location as factors on the course level success of dual enrolled students. In its review of studies of online learning published from 1996 to 2008, the U.S. Department of Education (DOE) found students in online courses slightly outperformed students in the same courses delivered in a traditional, face-to-face format (Means, Toyama, Murphy, Bakia, & Jones, 2010). However, criticism of these findings exists in regard to student populations. Some critics disagreed with the DOE's interpretation of the findings and argued that closer examination of the data suggests no advantage for classes taught in a fully online mode (Jaggars & Bailey, 2010). Furthermore, the DOE's report, which focused on well-prepared university students, is not generalizable across populations, particularly students from low SES backgrounds and students underprepared for college (Jaggars & Bailey, 2010). Some research indicated that student learning

outcomes in fully online classes were inferior to fully face-to-face courses, especially in the community college setting – which is the primary institution type for dual enrollment programs. One comprehensive study using a larger, statewide dataset found that in the community college setting, "online format had a significant negative impact on both course persistence and course grade" (Xu & Jaggars, 2013, p. 55)

In addition, the overwhelming majority of such studies have focused on adult students (Driscoll, Jicha, Hunt, Tichavsky, & Thompson, 2012; Xu & Jaggars, 2013). The DOE's literature review found that, despite growth in number of K-12 public schools students taking distance education classes, there have been very few robust studies on the effectiveness of online learning for this population (Means et al., 2010). This report did not mention a breakdown of those few studies in terms of applicability to dual enrolled students.

In terms of course delivery location, very little research has been published comparing success of dual enrolled students on high school sites versus college sites. In one study, the focus was on classes taught by high school teachers, not college teachers (Flores, 2012). A second study also examined course delivery location as a predictor variable for dual enrollment course success, but yielded mixed results (Arnold, Knight, & Flora, 2017). Some other researchers have found the same gaps in the literature. For example, dissertation work completed in 2016 indicated such gaps and included recommendations for future research on delivery modes and locations (Hughes, 2016).

Conceptual Framework: Anticipatory Socialization Theory

This study will be conducted through the lens of Merton's (1968) anticipatory socialization theory which hypothesized, in part, that an "individual who adopts the

values of a group to which he aspires but does not belong" will have an easier transition once he becomes a part of that group (p. 319). Pascarella, Terenzini, and Wolfle (1986) applied Merton's theory to the college setting and found precollege orientation programs provided experiences for students to gain knowledge to more successfully transition and integrate into college. More recently, Hughes (2016) used anticipatory socialization theory to frame his findings that dual enrolled students who had college experiences while still in high school were more successful upon entering college as adults.

These previous applications of Merton's theory to higher education socialization have focused on long term successes, such as persistence (Pascarella et al., 1986), and bachelor's degree attainment and time to degree completion (Hughes, 2016). However, anticipatory socialization might also play a role in shorter term outcomes such as course level success. Dual enrolled students who have more experiences to help them anticipate and, subsequently, adopt the values and appropriate behaviors of successful college students in individual courses might in turn become more successful themselves. Therefore, anticipatory socialization theory could be used to predict greater success for high school students with more contact with traditional college students. For the purposes of this study, that would mean dual enrolled students taking face-to-face classes on the college site as opposed to the high school site or via distance education might experience higher course level success because greater observation of, and interaction with, adult students would occur.

Purpose Statement

The purpose of this study was to examine the correlation between course delivery location (high school or college campus) for college classes taken by dual enrolled

students in North Carolina to student success as defined by final grades in those courses. In addition, this study examined the correlation between course delivery mode (face-to-face, hybrid, or online) for college classes taken by dual enrolled students in North Carolina to student success as defined by final grades in those courses.

Research Questions

The study addressed the following research questions:

1. To what extent does course delivery location (high school or college campus) for college classes taken by dual enrolled students correlate with student success as defined by final grades in those courses?

2. To what extent does delivery mode (face-to-face, hybrid, or online) of college classes taken by dual enrolled students correlate with student success as defined by final grades in those courses?

Professional Significance

While existing research has provided insights into impact of online delivery mode for course success in adult populations attending universities and community colleges, few studies have dealt with the K-12 population of which dual enrolled students are a part (Means et al., 2010). In addition, almost no research has addressed differences in course success for students taking courses on college campuses versus high school sites. Students, in conjunction with their parents and high school counselors, may choose courses based on the convenience and flexibility options such as distance education or high school site delivery, if available, offer. With no prior experience taking college-level coursework and little, if any, experience taking online classes at all, students in dual enrollment programs, especially those in their first semester of college coursework, may

not realize until it is too late that particular delivery modes are not well-suited for their learning styles.

From institutional funding and efficiency perspectives, colleges and universities often adopt a consumer driven approach to course scheduling. Certainly, in the prevalent funding models across the country, enrollment is a driving force and, thus, enrollment trends may help drive scheduling practices. In addition to increasing college access for students, however, administrators have a responsibility to ensure student success.

The present study sought to identify the more advantageous course delivery modes and locations for dual enrollment populations. Equipped with this information, higher education administrators will be better able to steer course scheduling conversations with high school staff, students, and their parents in an effort to improve course level success as a mediator to other measures of academic success. With improved course level success, institutions would likely see improved retention and completion rates.

Overview of the Methodology

This quantitative, causal-comparative study used *ex post facto* data from four community colleges in the North Carolina Community College System (NCCCS). Not all participants at all sites had the same options for course delivery mode and location. Therefore, it was impractical to randomly assign participants to control and experimental groups. In addition, the population consisted solely of high school students, most of whom were under the age of 18 and who, thus, required a higher threshold for protection from harm than would adult students. Finally, restricting students from their preferred

course delivery modes and locations for the purposes of this study might have been considered unethical. For these reasons, a true experimental design was inappropriate.

Representative NCCCS institutions included both urban and rural schools as well as schools from the eastern, central, and western regions of the state. Data from the 2016-17 academic year was used. The offices of institutional effectiveness and research at the representative institutions collected the data using the NCCCS Colleague data system and exported it to usable spreadsheet files.

Participants included students in dual enrollment pathways in North Carolina as authorized by the Career and College Promise (CCP) program: College Transfer Pathways (CTP), Career and Technical Education Pathways (CTE), and Cooperative Innovative High School Programs (CIHSP) (State Board of Community Colleges, 2017).

The main independent variables of interest were the location of course delivery (high college campus or high school) and delivery mode (face-to-face, hybrid, or online). The dependent variable, course grade, was a measure of academic success. Thus, it was important to attempt to control for prior academic ability, so a pretest in the form of high school GPA at the time students were admitted into the Career and College Promise program was used. The study controlled for other potentially confounding variables: race, gender, dual enrollment pathways, and post-secondary institution size.

The study involved multiple groups with categorical independent variables and covariates, a continuous covariate, and an ordinal dependent variable. Given these parameters, data were analyzed utilizing a factorial ordinal logistic regression, performed in SPSS version 24.

Delimitations

This study was limited to dual enrolled high school students taking college courses through North Carolina community colleges under the auspices of the Career and College Promise program during the academic year 2016-17. The study was further limited by selection of four community colleges out of the fifty-eight member institutions in the NCCCS. Colleges were selected to provide system-wide representation based on geographic location (eastern, central, and western parts of the state), size (three tiers based on FTE range), and whether urban or rural. Such selection was an attempt to enhance generalizability across the NCCCS.

Definitions of Key Terms

The following listing serves as a reference for key terms used during this study:

Advanced Placement (AP): College-level courses approved by the College Board and taught by high school teachers to high school students for high school credit. College credit may also be awarded if the student scores high enough on the end of course exam. The awarding of AP college credit is at the discretion of individual postsecondary institutions.

Asynchronous: Online courses delivered via learning platforms in which no class meetings take place. Example learning platforms include Blackboard, Canvas, and Moodle.

College or university site: Facilities owned (or leased) and operated by a postsecondary institution for the purpose of delivering instruction.

Concurrent enrollment: College-level courses taught by high school teachers to high school students for college credit, excluding AP and IB.

Concurrent enrollment program: Partnership agreement between a secondary and postsecondary institution which allows high school students to enroll in college courses taught by high school teachers for college credit prior to graduating high school, excluding AP and IB.

Course delivery location: The physical site of classrooms in which students take face-to-face classes.

Course delivery mode: The method through which students receive instruction, whether face-to-face, internet, or hybrid.

Dual credit: Courses which may count for both high school and college credit.

Dual enrollment courses: College-level courses taught by college instructors to high school students for college credit.

Dual enrollment program: Partnership agreement between a secondary and postsecondary institution which allows high school students to enroll in college courses taught by college instructors for college credit prior to graduating high school.

Early college high school: Specialized high school which provides students the opportunity to receive a high school diploma and an associate degree or up to two years of college credit by participating in a dual enrollment program. Typically targets traditionally underrepresented populations. Offers more flexibility and support than traditional high school dual enrollment programs.

Face-to-face: Course delivery mode in which all of the required contact hours take place in a physical space with an instructor present.

Final course grade: The letter grade students receive at the end of a course and which appears on the college transcript.

High school site: Facilities owned (or leased) and operated by a secondary institution for the purpose of delivering instruction

Hybrid: Course delivery mode in which a portion of the required contact hours take place in a physical space with an instructor present and a portion of the required contact hours take place in an online setting.

International Baccalaureate (IB): College-level courses approved by the International Baccalaureate organization and taught by high school teachers to high school students for high school credit. College credit may also be awarded if the student scores high enough on the end of course exam. The awarding of IB college credit is at the discretion of individual postsecondary institutions.

Online: Course delivery mode in which all of the required contact hours take place in an online setting, including asynchronous, internet and synchronous, teleconferencing delivery modes.

Synchronous: Online courses with class meetings that take place at a set time via teleconferencing technology. Example meeting platforms include WebEx and Adobe Connect. May also integrate an asynchronous learning platform for course support.

Summary

Dual enrollment programs have greatly increased access to college for students in recent years. To facilitate such access, post-secondary institutions utilize a variety of delivery mode and location options. Among public, two-year colleges, 83% teach classes on the college campus, 83% teach classes on the high school campus, and 68% teach classes through distance education (Marken, Gray, & Lewis, 2013). However, little research exists examining the impact of such delivery choices on course success rates.

While some research has indicated that the distance learning format has a negative impact on course grade for community college students, these data related only to adult populations (Xu & Jaggars, 2013). Despite tremendous growth in online learning opportunities for K-12 public school students, few studies have addressed effectiveness of this format for this population (Means et al., 2010). In addition, few existing studies examining the effect of course delivery site on course success were found. This study proposed to help fill in these specific gaps in the literature surrounding dual enrollment.

The remaining chapters of this dissertation are organized as follows: Chapter 2 will provide a literature review on the topic of dual enrollment including a history, benefits and limitations, impact of course delivery mode and location on course level success, and anticipatory socialization theory as a framework for the study. Chapter 3 will address the methods that will be used in this quantitative, *ex post facto* study. Chapter 4 will report the study's findings. Finally, chapter 5 will include a discussion of the findings, implications for practices in dual enrollment programs, and recommendations for future research.

Chapter 2

Literature Review

This chapter focuses on the literature surrounding dual enrollment programs and their role in contributing to increased access to and success in postsecondary education. Following the methods of the literature review, the chapter provides a history of dual enrollment programs in general and, more specifically, in North Carolina. Next are the benefits and limitations of student participation in dual enrollment programs in the United States. The review then examines existing studies of the impact of delivery mode and location on course level success and exposes gaps in the literature in this area for this population. Finally, the chapter concludes with a discussion of anticipatory socialization theory as a lens for this study.

Method of the Literature Review

The original literature review encompassed peer reviewed articles written in English and published within the last five years. A Boolean search of electronic databases yielded 80,981 sources from the past five years based on specific query terms: dual enroll* OR concurrent enroll* AND education AND success. Selecting only peer-reviewed journals further limited the results to 38,601. Focusing on the Education Resources Information Center (ERIC) database produced 2,390 articles. Finally, the results were sorted by relevance. From there, a manual scan of article titles and abstracts identified articles most likely to benefit the present study.

In addition, two key resources provided references pages for further investigation. In their comparative analysis of Advanced Placement (AP) and dual enrollment programs, Khazem and Khazem (2014) provided background information on each

program, including their designs and uses. A screening of this article's references produced additional resources on the benefits and limitations of dual enrollment programs. Secondly, in his dissertation, Hughes (2016) critically analyzed previous studies on the impact of dual enrollment participation. These two sources allowed for the inclusion of important literature beyond the five-year scope of the database search.

History of Dual Enrollment

As of March 2016, 47 states plus the District of Columbia had state policies in place to regulate dual enrollment programs (Zinth, 2016). Such widespread regulation has followed the growth of dual enrollment programs in the U.S., with 82% of high schools offering some type of dual enrollment program (Thomas et al., 2013). As seemingly ubiquitous as dual enrollment programs have now become, this proliferation occurred over several decades.

High school students have been able to earn college credits through programs such as Advanced Placement (AP), created in the 1950s, and the International Baccalaureate (IB), established in the 1960s, for a half century; however, true dual enrollment programs saw their beginnings in the 1970s with significant growth in the 1980s (Borden, Taylor, Park, & Seiler, 2013). Fincher-Ford (1997) credits Syracuse University's Project Advance (SUPA), established in 1973, as the first dual enrollment partnership between a secondary and post-secondary institution. The following year LaGuardia Community College's Middle College High School was created in New York (Kim, 2008). In terms of statewide systems, California, known for its progressive education policies, enacted the first state policy on dual enrollment in 1976 (Mokher & McLendon, 2009). By 1980, only two more states, Oklahoma and Florida, had adopted

dual enrollment policies, but in the decade leading up to 1990, another 14 states followed suit (Mokher & McLendon, 2009). In 2000, all but 13 states had adopted dual enrollment policies, and in 2016, only 3 states remained with no such state legislation Zinth, 2016).

Several concurrent issues account for the growth of dual enrollment programs: "the increasing importance of a higher education degree for economic security and social welfare; low and seemingly intractable degree completion rates; and the rising costs to students for attending college and the attendant growth of college loan debt" (Borden et al., 2013, p. 1). In addition, several influences exist that have impacted the likelihood of states to adopt regulatory dual enrollment policies. States with a large public, two-year higher education sector are more likely to encourage dual enrollment (Mokher & McLendon, 2009). This helps explain why states, such as California and North Carolina, with well-developed community college systems were early adopters of dual enrollment programs. In addition, states with Republican controlled legislatures and states with centralized higher education governing boards are also more likely to adopt dual enrollment policies (Mokher & McLendon, 2009).

Since the turn of the century, one specific type of dual enrollment program, the early college high school, has seen tremendous growth. Low-income, first-generation, and/or racial and ethnic minority students are less likely to be college ready (Goldrick-Rab & Cook, 2011). Early college high schools target these traditionally underrepresented populations to improve college readiness. The Early College High School Initiative (ECHSI) established by the Bill & Melinda Gates Foundation in 2002 provided financial support for the creation of over 200 early college high schools across 24 states (Berger, Turk-Bicakci, Garet, Knudson, & Hoshen, 2014). The initial goal of

the ECHSI was "ensuring that 80 percent of students graduate from high school prepared for college, with a focus on low-income and minority students reaching this target" (Bill & Melinda Gates Foundation, 2009, p. 3). In an impact study to determine if the ECHSI initiative was meeting its goal, the American Institutes for Research found "81 percent of Early College students enrolled in college, compared with 72 percent of comparison students" and 25 percent of Early College students earned a college degree (typically an associate's degree), as compared with only 5 percent of comparison students (Berger et al., 2014, p. iv). Based on such successes, the Early College High School model has continued to grow across the country.

North Carolina Dual Enrollment Models

Dual enrollment programs were first offered in North Carolina in 1983 with the enactment of Session Law (SL) 1983-596 [House Bill (HB) 1044], "An Act to Authorize Local Administrative Boards of Community Colleges to Establish Cooperative Programs with High Schools." This statute amended the general provisions for state administration of community colleges with this statement:

> Provided, notwithstanding any law or administrative rule to the contrary, local administrative boards and local school boards may establish cooperative programs in the areas they serve to provide for college courses to be offered to qualified high school students with college credits to be awarded to those high school students upon the successful completion of the courses. (An Act to Authorize Local Administrative Boards of Community Colleges to Establish Cooperative Programs with High Schools, 1983)

In the decades following this legislation, a variety of joint high school programs were created in North Carolina to serve multiple purposes. Each program had its own regulations on student eligibility and program funding, and the creation of each was accompanied by different statutory guidelines. By 2010, four separate joint high school programs existed in North Carolina: Huskins, Concurrent Enrollment, Cooperative Innovative High Schools, and Learn and Earn Online (Jordan, 2010). A legislative report indicated that having such varied dual enrollment programs was "ineffective and inefficient" and caused "unnecessary confusion and frustration for students and their families" (Jordan, 2010, p. 3).

Subsequent efforts to streamline dual enrollment programs in North Carolina led to the creation of the Career and College Promise program in 2012:

> The purpose of Career and College Promise is to offer structured opportunities for qualified high school students to dually enroll in community college courses that provide pathways that lead to a certificate, diploma, or degree as well as provide entry-level jobs skills. (State Board of Community Colleges, 2017)

Career and College Promise (CCP) offers three pathways for dual enrolled students to earn college credits while still in high school. College Transfer Pathways provide the opportunity for students enrolled at traditional high schools to earn "[t]uition free course credits toward the Associate in Arts, Associate in Science, Associate in Engineering, [or] Associate Degree Nursing programs" (State Board of Community Colleges, 2017, p. 14-4). Similarly, Career Technical Education Pathways offers traditional high school students opportunities to earn "[t]uition free course credits toward an entry level job credential, certificate or diploma" (State Board of Community Colleges, 2017, p. 14-4). Finally,

Cooperative Innovative High School Programs (CIHS) "[l]ead to the completion of a high school diploma and associate degree or provide up to two years of college credit within five years" (State Board of Community Colleges, 2017, p. 14-4). Participation in CIHS programs requires matriculation at an approved Cooperative Innovative High School, more commonly referred to as Middle Colleges or Early College High Schools.

Except for any courses offered on a self-supporting basis, tuition for CCP students is waived. Student fees are not legislatively waived; however, operating procedures allow individual community colleges to waive them (State Board of Community Colleges, 2017). Students or their parents are responsible for purchasing textbooks although in many public school districts, these costs are covered by the individual high school or the school district itself. Given these parameters, many North Carolina students are able to participate in the CCP program and earn college credits with zero cost to the student.

Benefits and Limitations of Dual Enrollment

Participation in dual enrollment programs carries with it a number of benefits for students who transition to college as adults. However, a number of drawbacks for such programs exist as well.

Benefits. While a number of other benefits of participation in dual enrollment may exist, this literature review focuses on three major ones: cost savings, increased academic success, and reduced time to degree completion.

Cost savings. Dual enrollment programs in traditional high schools provide students the opportunity to earn college credits while still enrolled in high school. A greater percentage of community colleges than universities serve as the post-secondary education partner to high schools with dual enrollment programs (Marken et al., 2013).

Because of the difference in the total cost of community colleges and universities, students and their parents can realize huge savings by participating in dual enrollment programs linked to community colleges.

In its annual report entitled *The Condition of Education,* the U.S. Department of Education indicated the average annual cost for first-time, full-time college students at four-year, public institutions is $13,690; this figure rises to $22,190 when room and board are included (Kena et al., 2015). At two-year, public institutions, the average annual cost (not including room and board) for first-time, full-time college students is $8,530 (Kena et al., 2015). Most students at four-year institutions require room and board, and dual enrolled students do not require room and board since they live at home. Therefore, the savings a dual enrolled student could see by earning a year's worth of college credit during his or her high school career while living at home is $13,360. For students who earn the full two-year, associate's degree while in high school, the savings doubles to $27,320.

However, the savings in *total cost of attendance* does not fully demonstrate the financial benefits of dual enrollment participation. Many students qualify for various types of financial aid: grants, scholarships, and work study. The *net cost of attendance* is the out-of-pocket expense after these funds are applied. Four-year institutions have an average net annual price of $12,890 (Kena et al., 2015), so students may need to use student loans. However, the average net annual price at community colleges has been negative (Rose, 2013). Thus, the average community college student is more likely to receive a refund check than a bill.

This savings model applies to dual enrolled students in states where students and their parents pay college costs. Some states employ a model in which the high school covers those costs. Other states, like North Carolina, offer a full tuition waver to dual enrolled students. In North Carolina, many high schools even purchase textbooks for their students to use in college courses. States with funding models such as these offer an even greater monetary benefit. Students in these states can potentially realize the full savings of the average cost for a year ($22,160) or potentially two years ($44,320).

Increased academic success. Research associates prior participation in dual enrollment programs with increased success in the first year of college in terms of GPA and persistence. First-year, full-time college students with experience in dual enrollment programs have higher GPA's (Allen & Dadgar, 2012; Jones, 2014; Karp et al., 2007) and first year persistence rates than their counterparts with no dual enrollment experience (Jones, 2014; Karp et al., 2007). Such success has been seen in multiple states. For example, in North Carolina, dual enrollment students who took no dual enrollment courses in high school averaged a 1.63 first-year GPA while students who took six or more dual enrollment courses averaged a 2.08 first-year GPA (Ganzert, 2014). Students in the same study graduated at higher rates if they had experience with dual enrollment, at a rate of 34.8%, than if they had no experience, a rate of 22.5% (Ganzert, 2014). Students in Florida and New York saw results similar to North Carolina; prior dual enrolled students in these states had higher first-year GPA's and also persisted longer (Karp, et al., 2007).

Reduced time to degree completion. Students with prior dual enrollment experience complete their bachelor's degrees faster than students with no dual enrollment

experience (Allen & Dadgar, 2012; Ganzert, 2014; Hughes, 2016). In this regard, students with prior dual enrollment experience even have an advantage over students who earn college credits through other programs such as Advanced Placement (AP) classes in high school (Klopfenstein & Lively, 2012). Although AP classes provide the opportunity to earn college credits, they are still high school classes, so no socialization to college culture occurs. In addition, AP students have to pass the AP exams with certain scores to be eligible for college credit. The scores required as well as the college credit awarded vary by institution. Because of these factors, prior AP students do not graduate any faster with the four-year degree than students who took no college-level courses in high school whatsoever (Klopfenstein & Lively, 2012). Prior dual enrolled students, however, earn their bachelors' degree significantly faster than either former AP students or students who didn't participate in either program (Klopfenstein & Lively, 2012). Some advantages may exist for students taking AP classes, but reducing the time needed to complete the bachelor's degree does not appear to be one of them.

Limitations. Considering the variation in dual enrollment policies across states, several limitations exist for dual enrollment programs and students.

Transferability of credit. State policies governing transferability of dual enrollment credit are anything but uniform. Furthermore, even though many states have statewide transfer policies, "receiving institutions may have discretion to accept or deny community college dual credit courses if state dual credit policy does not explicitly require that courses transfer" (Taylor, Borden, & Park, 2015, p. 16). Currently, only half of states require all public two-year and four-year institutions to accept dual enrollment credits (Zinth, 2016). Four states require transfer credit recognition of one but not all state

dual enrollment programs while fifteen states do not require dual enrollment credit to transfer at all (Zinth, 2016). The remaining six states do not have clear policy to address transferability of dual enrollment credits (Zinth, 2016). Pretlow and Patteson (2015) noted that implementation of policy does not always follow the written plan and that the "process of translating policy into actionable programs is further complicated when a policy is vaguely written" (p. 24). The resulting ambiguity can lead to confusion for institutions, administrators, students, and parents in terms of what courses are authorized or guaranteed to transfer to post-secondary institutions (Pretlow & Patteson, 2015).

Beyond state policy, the level of admissions competitiveness at receiving institutions may also influence how well dual credits transfer. Using *Barron's Profiles of American Colleges* to establish a measure of selectivity, Modarelli (2014) found the most selective colleges and universities accepted dual enrolled transfer credits at a significantly lower rate than moderately selective intuitions.

Perceptions of quality and rigor. The question of quality and rigor helps inform credit transfer practices. While some research indicates that faculty feel rigor in dual enrolled classes is at least as high if not higher than in traditional classes (Fergus, Baker, & Burnett, 2015), those external to postsecondary institutions may still have qualms. The biggest concern over quality of dual enrollment courses centers on concurrent enrollment courses, a subset of dual enrollment programs in which college classes are taught to high school students by high school teachers. Skeptics argue that such courses lack instructional quality compared to those taught by properly credentialed, postsecondary instructors. Even when high school instructors hold the same master's degrees as their

college counterparts, many institutions still view programs based on high-school campuses with skepticism (Gewertz, 2016).

Increasingly, regional accrediting agencies' have begun to focus on quality assurance for dual enrollment courses (Taylor et al., 2015). Taylor et al. (2015) identified two primary avenues through which dual enrollment quality and rigor can be ensured: state level policies and institutional adherence to standards of quality established by the National Alliance of Concurrent Enrollment Partnerships (NACEP). In an effort to stay in compliance with accrediting bodies, policymakers in many states have developed guidelines to address issues surrounding quality and rigor. Forty-one states have instructor and course quality components (Zinth, 2016). About 80% of state policies require dual enrollment instructors to hold the same credential as regular faculty members (Taylor et al., 2015). Program quality can also be maintained through adoption of policies on student eligibility (Karp, Bailey, Hughes, & Fermin, 2004; Karp, Bailey, Hughes, & Fermin, 2005). Taylor et al. (2015) also found 80% of dual enrollment state policies regulated student eligibility through various criteria: high school student class level, GPA, exam requirements, and course prerequisites that match those for traditional students.

In states lacking dual enrollment policies, quality control issues may be left up to the institution. In cases such as these, Scheffel, McLemore, and Lowe (2015) argued for the adoption of rigor control measures through voluntary accreditation from NACEP.

Cost barriers. State policies on tuition payment for dual enrolled students vary widely. Only five states legislatively fund dual enrollment while another four allow for individual school districts to cover tuition costs (Zinth, 2016). In many states, funding varies by type of dual enrollment program, or funding either can be a local decision or

else left up to the parent to provide (Zinth, 2016). Lack of tuition regulation for dual enrollment programs in some states has led to what Pretlow and Patteson (2015) referred to as market approach, in which postsecondary institutions compete for dual enrolled students by lowering their tuition rates slightly in comparison to other institutions. While this practice can result in slightly lower tuition for dual enrolled students, it could ultimately compromise the effectiveness of dual enrollment programs on a state level (Pretlow & Patteson, 2015)

With no policies in place in many states to cover tuition, participation in dual enrollment by lower socio-economic status students can be negatively impacted. For example, 85% of students attending Tulsa Public Schools and 62% of students at Union Public Schools qualified for free or reduced lunch and had difficulty affording the tuition, fees, and textbooks required in Oklahoma's dual enrollment program (Roach, Gamez Vargas, & David, 2015). Such limitations have led to the introduction of national legislation to help mitigate cost barriers. The Making Education Affordable and Accessible Act, an amendment bill to the Higher Education Act of 1965, would award grant money to dual enrollment programs if passed. Priority for grant awards would be given to "institutions that serve students from low-income families, students from rural communities, or students who are the first in their family to receive postsecondary education" (Making College Affordable and Accessible Act of 2016, 2016). In addition, the U.S. Department of Education (2016) has authorized an experiment which will "waive existing financial aid rules that prohibit high school students from accessing Federal Pell Grants" (para. 7). Forty-four postsecondary institutions from twenty-three states are currently participating in the experiment (U.S. Department of Education, 2016).

However, it may be some time before the results of the experiment are released, and it may take even longer before a decision is made on whether to fully implement Pell Grant funding for dual enrolled students on a national level.

Limitations Addressed in the North Carolina Model

Some of the strengths of the North Carolina Career and College Promise program revolve around how such limitations to dual enrollment programs are addressed. These issues are discussed below.

Transferability of credit. In terms of transferability of credit, the *Comprehensive Articulation Agreement (CAA) Between the University of North Carolina and the North Carolina Community College System* governs how credits are accepted by receiving, public institutions within the state (Board of Governors of The University of North Carolina & the State Board of The North Carolina Community College System, 2014). Community college students who complete a full Associate in Arts or Associate of Science degree are guaranteed to have all their credits accepted upon admission to any of the sixteen UNC institutions and will have been deemed to have met the requirements to obtain junior standing. Students who transfer from community colleges without the full degree may have their transcripts evaluated using institutional parameters. However, a subset of general education courses, referred to as Universal General Education Courses (UGETC) are guaranteed to transfer as required general education courses under any circumstances. Courses not designated as UGETC must still be accepted, but could be awarded elective only credit, depending on individual institutional guidelines. Similar transfer protections are afforded students who transfer to one of the twenty-four signatory, private institutions as a part of the *2015 Independent Comprehensive*

Articulation Agreement Between the North Carolina Community College System and Signatory Institutions of North Carolina Independent Colleges and Universities (North Carolina Independent Colleges and Universities Board of Governors of North Carolina Independent Colleges and Universities & the State Board of The North Carolina Community College System, 2015). Career and College Promise students have the same transfer guarantees as adults under the CAA. The three dual enrollment college transfer pathways (Associate of Arts, Associate of Engineering, and Associate of Science) must align with the adult programs of study, and courses taken are not labeled as dual enrollment on transcripts, but as normal community college courses (State Board of Community Colleges, 2017).

Perceptions of quality and rigor. Questions of quality and rigor are handled in CCP via faculty credentialing and student eligibility guidelines. In North Carolina, college faculty credentialing is governed by its accrediting agency, the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC). All faculty must meet the same requirements, regardless of teaching dual enrolled or traditional students:

> The institution employs competent faculty members qualified to accomplish the mission and goals of the institution. When determining acceptable qualifications of its faculty, an institution gives primary consideration to the highest earned degree in the discipline. The institution also considers competence, effectiveness, and capacity, including, as appropriate, undergraduate and graduate degrees, related work experiences in the field, professional licensure and certifications, honors and awards, continuous documented excellence in teaching, or other

> demonstrated competencies and achievements that contribute to effective teaching and student learning outcomes. For all cases, the institution is responsible for justifying and documenting the qualifications of its faculty. (Southern Association of Colleges and Schools Commission on Colleges, 2012, p. 30)

SACSCOC gives further guidance for general education, transferable courses:

> Faculty teaching associate degree courses designed for transfer to a baccalaureate degree: doctorate or master's degree in the teaching discipline or master's degree with a concentration in the teaching discipline (a minimum of 18 graduate semester hours in the teaching discipline. (Southern Association of Colleges and Schools Commission on Colleges, 2012, p. 30)

In addition to faculty competency and credentialing, student eligibility guidelines help ensure quality and rigor in NC dual enrollment programs. In order to participate in the CCP transfer pathways, students must "[b]e high school juniors or seniors; have a weighted GPA of 3.0 on high school courses; and demonstrate college readiness in English, reading and mathematics on an assessment or placement test" (State Board of Community Colleges, 2017). Such requirements help students be successful once enrolled in college level course, thereby, eliminating any need to slow the pace or dilute the content of dual enrolled courses.

Cost barriers. The problem of cost has been given much consideration in the CCP program:

1. All curriculum courses taken by Career and College Promise students at community colleges…are tuition-waived except courses offered on a self-supporting basis.

2. Textbooks are a student's responsibility, however there may be local provisions for them. A student's high school, the school district, or another local organization may cover these costs. Students should check with their principal or counselor to verify how these costs are paid.
3. Student fees (e.g., technology fees and insurance fees) are not waived for Career and College Promise students. However, local school districts and community colleges should work together to determine whether and how student fees will be paid for CCP participants. (State Board of Community Colleges, 2017)

Many community colleges in NC voluntarily waive student fees for CCP students. In addition, many public school districts cover the cost of textbooks. In such districts, CCP students can obtain college credit without any financial obligation of their own.

Course Delivery Mode

Research surrounding the efficacy of college course delivery modes has been varied and has produced inconsistent results and conclusions. In its review of studies of online learning published from 1996 to 2008, the U.S. Department of Education (DOE) found students in online courses slightly outperformed students in the same courses delivered in a traditional, face-to-face format (Means et al., 2010). In addition, the effect size was larger for delivery modes that could be termed blended or hybrid (Means et al., 2010). However, criticism of these findings exists in regard to student populations. Some critics disagreed with the DOE's interpretation of the findings and argued that closer examination of the data suggests no advantage for classes taught in a fully online mode (Jaggars & Bailey, 2010). Furthermore, the DOE's report, which focused on well-

prepared university students is not generalizable across populations, particularly students from low SES backgrounds and students underprepared for college (Jaggars & Bailey, 2010). Such criticism is especially relevant to the focus of the present research as many students participate in dual enrollment programs, in part, because of free or reduced tuition while they are still enrolled in high school.

More recent studies have produced mixed results, with some studies confirming equivalent student outcomes across delivery modes. Measuring performance on a common final exam in introductory business statistics courses, Haughton and Kelly (2015) found hybrid sections had similar student learning outcomes as face-to-face sections. However, they went on to argue that, because of these similar outcomes between the two delivery modes and because cost of teaching hybrids is less than traditional classes, hybrid courses could be a preferred mode where cost of course delivery is a major factor (Haughton & Kelly, 2015). Researchers found student performance in online and face-to-face sociology courses was comparable, with the caveat that such equivalency is reduced if online courses are not designed properly (Driscoll et al., 2012).

In contrast, some research indicated that student learning outcomes in fully online classes were inferior to fully face-to-face courses, especially in the community college setting. One comprehensive study using a larger, statewide dataset found that in the community college setting, "online format had a significant negative impact on both course persistence and course grade" (Xu & Jaggars, 2013, p. 55). Some smaller scale, course level focused studies produced similar results. In one such study, community college students taking upper level biology classes in a distance format had higher

attrition rates and lower course level GPA than students in face-to-face classes (Rosenzweig, 2012). The results of another community college study showed that students taking computer literacy courses were less successful in an online format and that the effect was magnified for students who did not meet college readiness benchmarks (Quillen, 2011). In a study involving a broad range of general education courses, Gregory (2016) found community college students were "significantly more likely to withdraw from a class than students in face-to-face sections" (p. 107).

Setting is key for the present study as dual enrolled students are more likely to be served by community colleges than universities (Marken et al., 2013). As community colleges become increasingly dependent on online courses to serve a diverse population, attention needs to be given to differences among populations.

Course Delivery Location

A subset of dual enrollment models, concurrent enrollment, involves high school teachers teaching college level classes to high school students. Most of the literature on concurrent enrollment concerns the need for rigor in such courses and is theoretical in nature; very little research comparatively examines course level success for students taking classes on high school sites versus college sites.

One study framed the comparison of locations in the context of rigor. Flores' (2012) *ex post facto* causal-comparative study examined course grades for English and mathematics courses taken by dual enrolled students at both high school and college sites but found no statistically significant differences between groups based on location. The "results suggest[ed] that when each setting adheres to the rigor of dual credit program

standards, academic quality is maintained [and] academic achievement is comparable between students in the two settings" (Flores, 2012, p. v).

A second study (Arnold et al., 2017) also examined course delivery location as a predictor variable for dual enrollment course success, but the results were mixed. Arnold et al. (2017) found dual enrolled students taking college-level English or mathematics on the college campus had lower course grades than dual enrolled students taking the same courses at high school sites or online; no significant differences were found for biology or history classes.

Gaps in the Literature

Two noticeable gaps exist in the literature on course delivery mode and location as factors on the success of dual enrolled students. First, although significant research has been done comparing the efficacy of online courses to face-to-face courses, the overwhelming majority of studies have focused on adult students. One finding from the DOE literature review was that, despite growth in number of K-12 public schools students taking distance education classes, there have been very few robust studies on the effectiveness of online learning for this population (Means et al., 2010). This report does not mention a breakdown of those few studies in terms of applicability to dual enrolled students.

Second, very little research has been published comparing success of dual enrolled students on high school sites versus college sites. D'Amico, Morgan, Robertson, and River (2013) found dual enrolled students taking classes on the college site were more likely to persist than students taking classes on the thigh school site. Wallace (2017) found dual enrolled students taking classes on the high school site reported higher levels

of self-efficacy on the College Academic Self-Efficacy Scale. However, neither study examined course grade as a measure of student success.

Another study did examine course grades for dual enrolled students, but compared grades between dual enrolled and traditional students (Crouse & Allen, 2014). While dual enrolled students were found to outperform traditional students in community college courses, the researchers noted a limitation of the study was that it did not examine the impact of course delivery mode or location because data on delivery mode was not available (Crouse & Allen, 2014).

The two previously discussed studies that examined course grades as related to course delivery location had a number of delimitations and limitations:

1. The scope of each study encompassed a single college.
2. The studies included a limited number of college courses.
3. The sample sizes were fairly low.
4. The research designs did not control for covariates.

(Arnold et al., 2017; Flores, 2012)

Accordingly, a lack of generalizability exists for these studies.

Some other researchers have found the same gaps in the literature. For example, dissertation work completed in 2016 indicated such gaps and included recommendations for future research on delivery modes and locations (Hughes, 2016). In addition, Arnold et al. (2017) and Flores (2012) suggested expanding the study of the topic to include multiple colleges.

Anticipatory Socialization Theory and Dual Enrollment

Sociologist Robert Merton (1968) first developed the concept of anticipatory socialization in his work on reference group behavior during his study of United States military populations. Anticipatory socialization refers to the "adoption of attitudes and values of a group to which one does not belong, serving the twin functions of facilitating a move into that group and easing the process of adjustment after becoming a member of it" (Colman, 2014). Merton found enlisted soldiers who adopted the attitudes and values of the group to which they aspired, officers, were more likely to be promoted and that such socialization would ease their transition into officer status (Merton, 1968).

Pascarella et al. (1986) applied the theory of anticipatory socialization to educational settings, specifically to high school populations transitioning to college. A two-day pre-college orientation provided new students with the opportunity to become familiar with expected behaviors of successful college students. The researchers found these anticipatory socialization experiences had a positive impact of social integration and persistence once the students enrolled in college courses (Pascarella et al., 1986).

More recently, Hughes (2016), Karp (2012) and Swanson (2008) have used anticipatory socialization theory in examination of dual enrolled populations. Hughes' (2016) results were "consistent with anticipatory socialization" in that dual enrollment "gives students experiences in navigating college and a jump-start on college credit accumulation" (p. 76). Karp (2012) argued that dual enrollment programs serve as a location in which students learn about the role of college students and become socialized to that role. In this process, students "learn normative expectations – the habits, attitudes, and behaviors of successful college students – and discover strategies to enact these

expectations successfully by seeing how other people react to their 'college tries'" (Karp, 2012, p, 23). Swanson (2008) found dual enrollment course participation provided a means of anticipatory socialization to college and, in so doing, had a positive effect upon persistence and degree attainment.

While not situated within the anticipatory socialization framework, a qualitative study that examined the experiences of students in dual enrollment program in Los Angeles supports the application of this theory. Kanny (2015) found students who participated in dual enrollment classes on a community college site became "aware of the more implicit skills and practices that are not only expected of college students, but also lead to enhanced academic success in college" (p. 62).

The previous applications of anticipatory socialization theory to dual enrollment populations have focused on long term college successes, such as persistence (Pascarella et al., 1986), and bachelor's degree attainment and time to degree completion (Hughes, 2016). However, anticipatory socialization might also provide a lens through which to predict shorter term outcomes such as course level success. If the anticipatory socialization experiences that dual enrollment provides hinges in part on increased contact with the reference group, traditional students, then one would expect dual enrolled students who have more classroom contact with traditional students to be more successful in terms of final course grades. Therefore, it is hypothesized that dual enrolled students taking classes on the college campus will experience greater anticipatory socialization and, subsequently, perform better than dual enrolled students taking classes on high school sites or online.

Conclusion

The benefits of participation in dual enrollment programs include significant college cost savings, increased academic success at college/university level, and reduced time to degree completion. However, the literature has not significantly addressed the finer points of which elements of dual enrollment programs are correlated with the highest subsequent student success. While the literature adequately documents the long-term benefits of dual enrollment participation, gaps in the literature regarding impact of dual enrollment course delivery mode and location on course level success still exist. This study proposes to advance the knowledge of dual enrollment programs by addressing these specific gaps. Chapter 3 provides an explanation of the research design, setting, participants, data sources and analysis, and the limitations of the study.

Chapter 3

Methodology

This chapter begins with a restatement of the purpose and research questions for the study. Next is an overview of the research design followed by a discussion of the study setting and participants. Then the data sources and analysis are fully discussed. The chapter concludes with identification of the limitations of the study and a summary of the chapter.

Purpose Statement

The purpose of this study was to examine the correlation between course delivery location (high school or college campus) for college classes taken by dual enrolled students in North Carolina to student success as defined by final grades in those courses. In addition, this study examined the correlation between course delivery mode (face-to-face, hybrid, or online) for college classes taken by dual enrolled students in North Carolina to student success as defined by final grades in those courses.

Research Questions and Hypotheses

The study addressed the following research questions:

1. To what extent does the course delivery location (high school or college campus) for college classes taken by dual enrolled students correlate with student success as defined by final grades in those courses?

2. To what extent does the delivery mode (face-to-face, hybrid, or online) of college classes taken by dual enrolled students correlate with student success as defined by final grades in those courses?

The study tested the following hypotheses:

Hypothesis 1: Course success will be statistically significantly higher for dual enrolled students taking classes on a college campus compared to dual enrolled students taking classes on a high school site.

Hypothesis 2: Course success will be statistically significantly higher for dual enrolled students taking classes delivered in face-to-face and hybrid modes compared to dual enrolled students taking classes delivered in a fully online mode.

Research Design

Using *ex post facto* data from representative community colleges in the North Carolina Community College System (NCCCS), this quantitative study employed a quasi-experimental design. Because course delivery modes and locations vary by institution, not all participants had the same options. Thus, it was impractical, if not impossible, to randomly assign participants to control and experimental groups. Additionally, students in dual enrollment programs are high school students, and most of them are under the age of 18; therefore, they would have required a higher threshold for protection from harm than would adult populations if a true experimental model had been employed. Finally, restricting students from their preferred course delivery modes and locations for the purposes of this study might have been considered unethical. Since participants could not be randomly assigned to groups, an experimental design was not employed in this study. As detailed in the appendix, the Old Dominion University Education Subjects Review Committee approved this study as exempt from IRB review.

When situations prevent a true experimental design, *ex post facto* designs can provide an alternative method to assess the extent to which independent variables may impact a dependent variable (Leedy & Ormrod, 2016). *Ex post facto* research is an

approach which examines "events that have already occurred and then collects data to investigate a possible relationship between these factors and subsequent characteristics or behaviors" (Leedy & Ormrod, 2016, p. 194). *Ex post facto* designs are also referred to as causal-comparative designs. Since no direct manipulation of the independent variable occurs and since the confounding variables cannot be fully controlled, causality cannot be claimed (Leedy & Ormrod, 2016). Still, causal-comparative designs are more rigorous than pre-experimental designs (Nachmias & Nachmias, 1987). Table 1 summarizes the study design and methods.

Table 1

Overview of Study Design and Research Methods

Research Questions	Dependent Variable	Independent Variables	Covariates	Analysis
RQ1	Final course grade	Course delivery location (high school or college campus)	Race, gender, HSGPA, postsecondary institution size, CCP pathway type	Ordinal logistic regression
RQ2	Final course grade	Course delivery mode (face-to-face, hybrid, or online)	Race, gender, HSGPA, postsecondary institution size, CCP pathway type	Ordinal logistic regression

Dependent variables. Most of the research on participation in dual enrollment programs and the impact on academic success has focused on outcomes when students matriculate to postsecondary institutions as adults: college GPA (An, 2015; Allen & Dadgar, 2012; Karp et al., 2007), first-year college persistence rates (Jones, 2014; Karp et al., 2007), time to bachelor's degree completion (Allen & Dadgar, 2012; Ganzert, 2014; Hughes, 2016), and bachelor's degree attainment (Ganzert, 2014; Hughes, 2016).

However, a gap in the literature exists surrounding short-term outcomes such as course level success. Therefore, the dependent variable for both research questions in the present study was final course grade as reported on an ordinal scale.

Final course grades in the NCCCS are reported as letter grades. During the analysis phase of this study, the dependent variable (course grades) was converted to an ordinal scale. Table 2 indicates the ordinal rank of course grades.

Table 2

Final Course Grade Reported on an Ordinal Scale

Letter Grade	Ordinal Score
A	4
B	3
C	2
D	1
W	0
F	-1

Grades of W (withdrawal) were included because, like F's, they do not represent successful completion of courses. Since this study examined course success as predicted by delivery mode and location, W's could not be ignored. The decision was made to rank order a grade of W above a grade of F because an F impacts GPA and satisfactory academic progress while a W does not impact GPA, but only satisfactory academic progress. In addition, given the choice, most students elect to take a W instead of an F.

Independent variables. Two primary, categorical independent variables existed for the current study. For the first research question, the treatment variable was course delivery location of face-to-face classes (college or high school site). For the second research question, the treatment variable was course delivery mode (face-to-face, hybrid, or online).

Covariates. Covariates included race, gender, high school GPA, postsecondary institution size, and CCP Pathway type. Prior research has identified a need to control for pre-treatment variables of race and gender when examining impact of dual enrollment participation on academic success (An, 2015; Karp et al., 2007). High school GPA is a significant predictor of college success (Belfield & Crosta, 2012; Bracco et al., 2014; Scott-Clayton, 2012). In a review of the literature on the relationships of institutional characteristics and student success, Darling-Hammond, Ross, and Milliken (2007) found institutional size is an important characteristic to consider for studies involving high school students. Finally, CCP Pathway types encompass programs of study with varying course requirements, especially in the mathematics and science general education areas. Because programs with higher level course requirements are less likely to attract lower performing students, this study controlled for CCP Pathways types.

Setting

Representative NCCCS institutions included both urban and rural schools as well as schools from the NCCCS's three size tiers, based on Full-Time Enrollment (FTE) enrollment. One small-enrollment college was included with FTE of fewer than 2,500 students. Two medium-enrollment college were included with FTE of between 2,500 and 6,499 students. Finally, one large-enrollment college was included with FTE over 6,500 students. In order to avoid selecting institutions with adjacent service areas and, therefore, potentially reducing representativeness across the state, one institution was selected from the coastal area, one from the piedmont, and one from the mountain region. To facilitate currency, data from the 2016-17 academic year was used.

Participants

The population for this study included all dual enrollment students in North Carolina taking courses via the CCP program. CCP incorporates several approved educational pathways: College Transfer Pathways (CTP), Career and Technical Education Pathways (CTE), and Cooperative Innovative High School Programs (CIHSP) (State Board of Community Colleges, 2017).

The total CCP population in North Carolina is in the tens of thousands (NC CIHS Joint Advisory Committee, 2017). In the fall of 2016, 37,855 students took 85,410 courses through CCP (Eads, Sieman, Schneider, & Self, 2017). When a population exceeds 5,000 members, a sample size of 400 is sufficient (Leedy & Ormrod, 2016). This study employed a purposive, non-probability sampling technique in which all dual enrolled students at each of the four representative community colleges were selected. Combined CCP enrollment at the four institutions exceeds 5,000 students. Based on system-wide data from fall 2016, students enroll in an average of 2.25 courses each semester. Doubling this number to account for the spring semester, expected course records exceeded 22,500 and, therefore, easily met sample size guidelines. The actual number of course records for the delivery location research questions was 14,262 and for the delivery mode research question was 19,891, again meeting sample size guidelines.

Students at traditional high schools dually enrolling in the CTP and CTE pathways must meet minimum high school GPA requirements and, therefore, secondary schools must provide high school GPA on CCP student applications. These students are typically in the junior or senior year of high school. Students enrolled in Cooperative Innovative High School Programs, such as early colleges or middle colleges, do not have

to meet minimum high school GPA requirements. In addition, these students may begin taking college classes as early as the first semester of ninth grade. Thus, no high school GPA may exist for this sub-population. Therefore, ninth grade students with no reported high school GPA were excluded from the research.

As indicated in Table 3, the study sample was mostly similar to the statewide population demographically. However, in terms of race, the statewide population had a higher percentage of Hispanics and lower percentage of White students than did the study sample. Gender makeup was identical.

Table 3

Career and College Promise Demographics Percentages

Race/Gender	Statewide*	Study Sample
American Native	1	1.8
Asian	2	3.4
Black	14	14.4
Hispanic	12	5.2
Pacific Islander	<1	0.2
Multiple	2	4.7
Unknown	6	4.2
White	62	66.2
Male	41	41
Female	59	59

*Data reported in rounded numbers. Source: (State Board of Education, 2018)

Data Sources

A data query report using the Entrinsik Informer data discovery and analytics platform was constructed. The Informer report was then shared with staff in the offices of institutional effectiveness and research at the four representative institutions who extracted the data from the NCCCS Ellucian Colleague data system at their institutions. The staff then exported the data into Excel spreadsheets for data analysis in the study.

Data Analysis

All data were analyzed using the statistical software, SPSS version 24. The study involved multiple groups with categorical independent variables and covariates, a continuous covariate, and an ordinal dependent variable. Given these parameters, analysis using an ordinal logistic regression model was appropriate (Garson, 2014). For multiple predictor variables, the logistic regression equation from which the probability of Y is predicted is given by:

$$P(Y) = \frac{1}{1 + e^{-(b_0 + b_1 X_{1i} + b_2 X_{2i} + \ldots + b_n X_{ni})}}$$

in which $P(Y)$ is the probability of Y occurring, e is the base of natural logarithms, b_0 is the Y intercept, b_1 quantifies the relationship between the predictor and the outcome, and X_1 is the value of the predictor variable (Field, 2013).

Ordinal regression, or the ordered logit model, was a better choice than some other potential models for this research design. "Ordinal regression avoids the measurement error inherent in OLS [ordinary least squares] regression using ordinal data. When the response variable is ordinal rather than nominal in data level, ordinal regression also has more statistical power than multinomial regression" (Garson, 2014, location 143).

Overall model fit. Two tests were used to assess the fit of the overall model. First, the log-likelihood statistic is "analogous to the residual sum of squares in multiple regression in that it is an indicator of how much unexplained information there is after the model has been fitted" (Field, 2013, p. 763). In SPSS, the log-likelihood is reported through the test of parallel lines. Garson (2014) recommended examination of the parallel lines output table to test whether the slopes of the independent variables are the same for

each level of the dependent variable. “The parallel lines test is non-significant in a well-fitting model which meets the parallel lines assumption” (Garson, 2014, location 377).

A second test for the fit of the model is analogous to use of R^2 in linear regression (Field, 2013). SPSS supports outputting of pseudo-R^2 statistics based on three computational models: Cox and Snell’s, Nagelkerke’s, and McFadden’s. Of these three, Nagelkerke’s is the most widely reported (Garson, 2014) and, thus, was used in the present study. Unlike R^2 in linear regression, the pseudo-R^2 should not be interpreted as a percent of the variance explained, but rather as an “additional measure of model effect size, with higher being better” (Garson, 2014, location 452).

Contribution of predictor variables. Analogous to the *t*-statistic in linear regression, the *z*-statistic in this logistic regression was examined to assess whether the *b* coefficient for predictor variables was significantly different from 0 and, therefore, whether predictors significantly contributed to the prediction of the outcome variable (Field, 2013). In SPSS ordinal logistic regression, the *b* coefficient is reported as a location parameter. The *z*-statistic is reported as z^2, known as the Wald statistic, which transforms the *z*-statistic so that is has a chi-square distribution (Field, 2013). Effects of predictor variables for which parameter estimates do not reach significance levels as determined by the Wald statistic were not interpreted.

Effect sizes for predictor variables in linear regression can be determined by using standardized b coefficients, or beta weights; however, there are no beta weights in ordinal regression (Garson, 2014). Instead, the odds ratio (the exponential of *B*) indicates the change in odds of falling within a given level of the ordinal dependent variable as a result of a unit change in the independent variable (Field, 2013). However, SPSS output does

not support odds ratios. Therefore, odds ratios were planned to be calculated by exporting parameter estimates into an Excel spreadsheet and exponentiating the estimates using the "exp ()" function as recommended by Garson (2014). Statistically significant odds ratios were to be used to compare the relative importance of the independent variables.

However, the frequency distribution of the dependent variable in this study required the ordinal regression analysis to be run using a complementary log-log instead of a logit link. For link functions other than the logit model, "the odds ratio cannot be computed and there is no equivalent direct interpretation of the parameter the estimates" (Garson, 2014, location 496). Therefore, effect size for predictor variables could not be calculated for this study.

Model two. After the initial model analysis was complete, a second model was run in which the data file was split. Courses taken by dual enrolled students were coded as Science, Technology, Engineering, or Math (STEM), NON-STEM, or Career and Technical Education (CTE). The split file model allowed comparison of the effects of independent variables and covariates by these three discipline types.

Limitations

The major limitation in this study was limited generalizability. Although the 58 community colleges in the NCCCS all adhere to the same Career and College Promise operating procedures, the institutions serve different geographic areas in the state with differing technology infrastructures, which could potentially impact efficacy of online course delivery and ability of high school students to travel to college campuses. Other researchers should also use caution when attempting to generalize the findings outside the state of North Carolina. Statewide dual enrollment policies vary in terms of

transferability of credits, program funding, quality control processes, and student eligibility requirements (Zinth, 2016).

Another limitation in this study existed due to its research design. This *ex post facto* design did not utilize a true experimental model and, thus, did not allow for the manipulation of the independent variables purposively. As a result, firm conclusions about cause and effect between the independent and dependent variables could not be drawn (Leedy & Ormrod, 2016).

Summary

The purpose of this study was to associate the course delivery location (high school or college campus) for college classes taken by dual enrolled students in North Carolina to their success as defined by final grades in those courses. In addition, this study examined the correlation between course delivery mode (face-to-face, hybrid, or online) for college classes taken by dual enrolled students in North Carolina to student success as defined by final grades in those courses. Using *ex post facto* data from representative community colleges in the NCCCS, the study utilized an ordinal logistic regression model to analyze the influence of the independent variables on the dependent variable. A limitation of this study was limited generalizability. Chapter 4 reports the findings of the study.

Chapter 4

Results

The purpose of this study was to examine the correlation between the course delivery location (high school or college campus) for face-to-face college classes taken by dual enrolled students in North Carolina to their success as defined by final grades in those courses. In addition, this study examined the correlation between course delivery mode (face-to-face, hybrid, or online) for college classes taken by dual enrolled students in North Carolina to student success as defined by final grades in those courses. Two primary independent variables (course delivery location and course delivery mode) as well as a number of covariates were included: race, gender, high school GPA, postsecondary institution size, and CCP Pathway type. This study used SPSS Version 24.0 to conduct statistical analysis. Specifically, the ordinal regression analysis described in Chapter 3 was applied to address each research question.

This chapter reports the results of the statistical analysis. The chapter is divided into three sections. The first section presents the results of the ordinal logistic regression for predicting course success by delivery location. The second section presents the results of the ordinal logistic regression for predicting course success by delivery mode. High school GPA was only able to be reported by one college. Therefore, sections one and two of this chapter report results from overall models not including high school GPA. Following the overall models in each section, subset models including high school GPA are presented. The third section of this chapter summarizes the results of the statistical analysis.

Course Success by Delivery Location

Research question one asked to what extent the course delivery location (high school or college campus) for college classes taken by dual enrolled students correlated with student success as defined by final grades in those courses. The hypothesis for research question one was that course success would be statistically significantly higher for dual enrolled students taking classes on a college campus compared to dual enrolled students taking classes on a high school site.

Combined data set. The sample of records for the combined data set on delivery location (excludes internet courses) from all four colleges included a total of 14,262 records. Table 4 lists the frequency distribution for the sample.

Table 4

Final Course Grade Frequencies: Delivery Location – Combined Data Set

Letter Grade	Frequency	Percent
A	6481	45.4
B	3820	26.8
C	2058	14.4
D	676	4.7
W	517	3.6
F	710	5.0
Total	14262	100.0

Model Adjustments. Originally, the analysis was planned as a logit model because this is the default for ordinal regression in SPSS and is "recommended when the dependent ordinal variable has relatively equal categories" (Garson, 2014, location 306). However, as illustrated in Figure 1, frequency counts established that higher categories of the dependent variable were more probable. Therefore, a complementary log-log model was used as recommended for this distribution type (Garson, 2014).

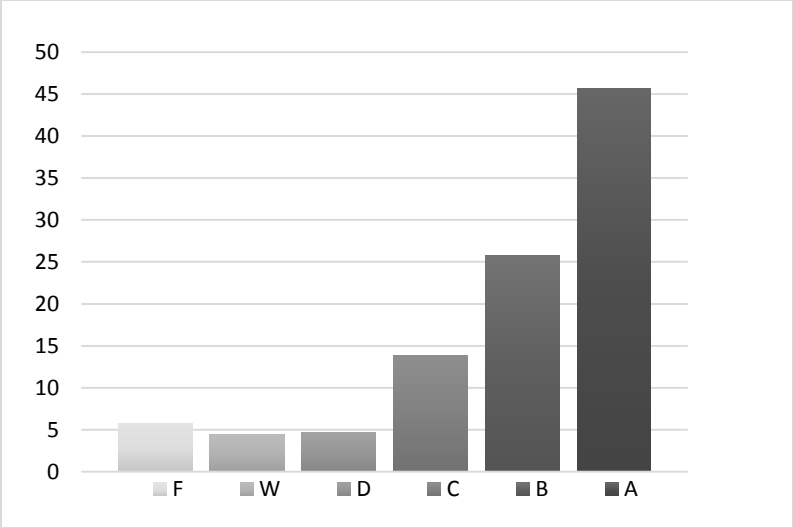

Figure 1: Distribution of Final Grades by Percent – Delivery Location

In the first run of the complementary log-log analysis, the parameter estimates indicated that not all the threshold (intercept) values for the dependent variable were significant. As indicated in Table 5, the estimate for OrdinalGrade = 3, the threshold between a B and an A letter grade, was not significant ($p = 0.786$). Non-significant thresholds indicate cutting points are not truly different, and some levels of the dependent variable should be combined (Garson, 2014).

Table 5

Thresholds: Delivery Location Original Model – Combined Data Set

Threshold	Estimate	Std. Error	Wald	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
[OrdinalGrade = -1.00]	-2.668	.350	58.101	.000	-3.354	-1.982
[OrdinalGrade = .00]	-2.101	.349	36.187	.000	-2.785	-1.416
[OrdinalGrade = 1.00]	-1.634	.349	21.948	.000	-2.318	-.950
[OrdinalGrade = 2.00]	-.807	.348	5.360	.021	-1.490	-.124
[OrdinalGrade = 3.00]	.094	.348	.074	.786	-.588	.777

To improve significance levels of the thresholds, several new iterations testing combinations of different levels of the dependent variable were run. A new best-fit model combining letter grades of A, B, and C produced threshold estimates that were all significant. As indicated in Table 6, estimates for the OrdinalGradeABC model all had significance levels of $p < 0.01$.

Table 6

Thresholds: Delivery Location ABC Model – Combined Data Set

Threshold	Estimate	Std. Error	Wald	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
[OrdinalGradeABC = -1.00]	-2.953	.685	18.568	.000	-4.296	-1.610
[OrdinalGradeABC = .00]	-2.385	.685	12.125	.000	-3.727	-1.043
[OrdinalGradeABC = 1.00]	-1.918	.685	7.845	.005	-3.260	-.576

Model fit. The proportionality of odds assumption, or parallel lines assumption, assumes slopes are identical for each threshold (Garson, 2014). The log-likelihood statistic indicates "how much unexplained information there is after the model has been

fitted" (Field, 2013, p. 763) and is reported in SPSS through the test of parallel lines. In a well-fitting model, the parallel lines test is non-significant (Garson, 2014). As Table 7 indicates, the log-likelihood statistic was significant, suggesting the model was not well-fit. However, the sample size, n = 14,262, was quite large. "Since the parallel lines test for large samples can report violation even for trivial differences in slopes, it is common in the literature to skip the test as unreliable" (Garson, 2014, location 1396).

Table 7

Test of Parallel Lines: Delivery Location – Combined Data Set

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	1411.930			
General	1267.406	144.524	26	.000

The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.[a]

a. Link function: Complementary Log-log.

The overall fit of the model is determined by the likelihood ratio test. A well-fitting model is significant by this test (Garson, 2014). As indicated in Table 8, the log likelihood value for the intercept-only null model was significantly different from the corresponding value for the full model, indicating a well-fitting model.

Table 8

Model Fitting Information: Delivery Location – Combined Data Set

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	1592.572			
Final	1411.930	180.642	13	.000

a. Link function: Complementary Log-log.

An additional measure of the model effect size for ordinal regression is the pseudo-R^2 statistic. As detailed in Chapter 3, this study used Nagelkerke's pseudo-R^2, the

most widely reported of three computational models. The Nagelkerke pseudo-R^2 was 0.019, indicating a weak effect size for the overall model.

Contribution of predictor variables. The *z*-statistic, reported as the Wald statistic, was examined to assess whether the *b* coefficient, reported as a location parameter estimate, for predictor variables was significantly different from 0 and, therefore, whether predictors significantly contributed to the prediction of the outcome variable. As indicated in Table 9, the following categorical predictors were significant: HighSchoolVsCollegeSite; CCP pathway types of CTE and CIHS; racial categories of Black, Asian, and MULTI; gender; and institution size for MediumCollege.

Table 9

Parameter Estimates: Delivery Location – Combined Data Set

Location	Estimate	Std. Error	Wald	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
[HighSchoolVsCollegeSite =.00]	-.572	.103	30.968	.000	-.774	-.371
[HighSchoolVsCollegeSite =1.00]	0a	.	.	.	.	.
[CTE=.00]	.589	.078	56.601	.000	.436	.743
[CTE=1.00]	0a	.	.	.	.	.
[CIHS=.00]	.239	.064	13.988	.000	.114	.365
[CIHS=1.00]	0a	.	.	.	.	.
[Black=.00]	.323	.066	23.957	.000	.193	.452
[Black=1.00]	0a	.	.	.	.	.
[Hispanic=.00]	.109	.100	1.197	.274	-.087	.305
[Hispanic=1.00]	0a	.	.	.	.	.
[NativeAmerican=.00]	.087	.156	.312	.576	-.219	.393
[NativeAmerican=1.00]	0a	.	.	.	.	.
[Asian=.00]	-.435	.160	7.380	.007	-.749	-.121
[Asian=1.00]	0a	.	.	.	.	.
[HawaiianPacificIslander=. 00]	.197	.583	.114	.735	-.945	1.339
[HawaiianPacificIslander=1 .00]	0a	.	.	.	.	.
[MULTI=.00]	.206	.104	3.912	.048	.002	.410
[MULTI=1.00]	0a	.	.	.	.	.
[NoneListed=.00]	-.088	.129	.471	.492	-.341	.164
[NoneListed=1.00]	0a	.	.	.	.	.
[Female=.00]	-.332	.046	51.165	.000	-.423	-.241
[Female=1.00]	0a	.	.	.	.	.
[MediumCollege=.00]	-.235	.076	9.479	.002	-.384	-.085
[MediumCollege=1.00]	0a	.	.	.	.	.
[LargeCollege=.00]	-.152	.078	3.807	.051	-.304	.001
[LargeCollege=1.00]	0a	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

All categorical predictors were reported as dichotomies. Estimates were reported for the all other categories. For example, in the category of HighSchoolVsCollegeSite, courses delivered on high school sites were coded as 1's, and courses delivered on college campuses were coded as 0's. Because the estimate reported was for HighSchoolVsCollegeSite=0, *not* taking courses on a high school site is associated with a decrease in final course grade. Or stated conversely, taking courses at a high school site was associated with an increase in final course grade. To understand the estimates better, it may be helpful to flip the sign of the estimate and associate it with the opposite category. For example, HighSchoolVsCollegeSite=0 with an estimate of -0.572 is the same as HighSchoolVsCollegeSite=1 with an estimate of 0.572.

For the covariate of CCP Pathway type, the CTP pathway (traditional high school college transfer) was the baseline. The CTE (career and technical education) was associated with lower final course grades. To a lesser extent, the CIHS pathway (cooperative innovative high schools, including early and middle colleges) was associated with a decrease in final course grade.

For the covariate of race, White was the baseline. Compared to all other races, being Asian was associated with an increase in final course grade, and being Black or Multi-racial was associated with a decrease in final course grade. For the covariate of gender, being female was associated with an increase in final course grade. For the covariate of institution size, attending a medium college was associated with an increase in final course grade.

In ordinal regression, "parameter estimates are converted to cumulative odds ratios to obtain effect size measures" (Garson, 2014, location 496). However, this

conversion only holds for logit link functions. For other link functions, "the odds ratio cannot be computed and there is no equivalent direct interpretation of the parameter estimates" (Garson, 2014, location 496). Because the frequency distribution of the dependent variable required the analysis to be run using a complementary log-log instead of a logit link, effect size of predictor variables could not be calculated for this study.

Combined data set – split file model. A second model was run which split the file into course type for comparison purposes. Based on the North Carolina Community College System common course library descriptions, courses were coded as STEM (transfer courses labeled with STEM general education categories), NON (transfer courses labeled with any other general education category), or CTE (all non-transfer courses). Although some CTE course titles seemed to place them in the category of STEM, subjective interpretation would have been needed to determine whether CTE courses should have truly been considered as STEM. Therefore, the decision was made to label courses using the objectivity of the common course library educational categories.

Model Adjustments. In the first run of the split file model, the parameter estimates indicated that not all the threshold (intercept) values for the dependent variable were significant. In order to find a best-fit model, multiple iterations of the split file were run, dropping categorical covariates one at a time and combining some levels of the dependent variable. The final split file model included course delivery location, CCP pathway type, Black race, and gender covariates. In addition, the thresholds for grades of A, B, and C were all combined.

Model fit. As indicated in Table 10, the log likelihood value for the intercept-only null model was significantly different from the corresponding value for the full model for three categories, indicating a well-fitting model for each.

Table 10

Model Fitting Information: Delivery Location – Split File Model

Course Type	Model	-2 Log Likelihood	Chi-Square	df	Sig.
CTE	Intercept Only	320.845			
	Final	245.929	74.917	5	.000
NON	Intercept Only	338.232			
	Final	265.567	72.665	5	.000
STEM	Intercept Only	250.865			
	Final	197.418	53.447	5	.000

Link function: Complementary Log-log.

Contribution of predictor variables. As indicated in Table 11, the new combined thresholds were all significant. In addition, the independent variable of delivery location (HighSchoolVsCollegeSite) was significant for CTE and STEM, but not NON-STEM, course types. Taking courses on a high school site was associated with higher final grades for both CTE and STEM courses, but the association was greater for STEM courses.

For the covariate of CCP pathway type, the CTE pathway was associated with a decrease in final course grades for the CTE course type. Both the CTE and CIHS pathway were associated with decreased final grades for the NON-STEM course type. The CIHS Pathway type was not significant for the CTE course type. Neither CTE pathway type was significant for STEM courses.

For the race covariate, being Black was associated with a decrease in final grade in all three course types, with the association being greater in the STEM course type than the Non-STEM course type and greater still in the CTE course type. For the covariate of

gender, being female was associated with an increase in final course grade for both STEM and NON-STEM courses.

Table 11

Parameter Estimates: Delivery Location – Split File Model

Course Type			Estimate	Std. Error	Wald	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
CTE	Threshold	[OrdinalGradeABC = -1.00]	-2.077	.404	26.390	.000	-2.870	-1.285
		[OrdinalGradeABC = .00]	-1.432	.401	12.762	.000	-2.218	-.646
		[OrdinalGradeABC = 1.00]	-1.035	.400	6.702	.010	-1.818	-.251
	Location	[HighSchoolVsCollegeSite=.00]	-.561	.119	22.400	.000	-.793	-.329
		[HighSchoolVsCollegeSite=1.00]	0[a]	.	.	.	.	.
		[CTE=.00]	.944	.362	6.785	.009	.234	1.654
		[CTE=1.00]	0[a]	.	.	.	.	.
		[CIHS=.00]	.503	.367	1.876	.171	-.217	1.223
		[CIHS=1.00]	0[a]	.	.	.	.	.
		[Black=.00]	.742	.130	32.527	.000	.487	.998
		[Black=1.00]	0[a]	.	.	.	.	.
		[Female=.00]	-.165	.103	2.583	.108	-.367	.036
		[Female=1.00]	0[a]	.	.	.	.	.
NON	Threshold	[OrdinalGradeABC = -1.00]	-2.587	.278	86.467	.000	-3.133	-2.042
		[OrdinalGradeABC = .00]	-2.070	.276	56.097	.000	-2.612	-1.529
		[OrdinalGradeABC = 1.00]	-1.623	.275	34.715	.000	-2.163	-1.083
	Location	[HighSchoolVsCollegeSite=.00]	-.244	.253	.931	.335	-.740	.252

		[HighSchoolVsCollegeSite=1.00]	0[a]	.	.	.	.	.
		[CTE=.00]	.668	.121	30.642	.000	.432	.905
		[CTE=1.00]	0[a]	.	.	.	.	.
		[CIHS=.00]	.298	.083	12.970	.000	.136	.460
		[CIHS=1.00]	0[a]	.	.	.	.	.
		[Black=.00]	.183	.085	4.659	.031	.017	.349
		[Black=1.00]	0[a]	.	.	.	.	.
		[Female=.00]	-.401	.065	38.246	.000	-.528	-.274
		[Female=1.00]	0[a]	.	.	.	.	.
STEM	Threshold	[OrdinalGradeABC = -1.00]	-4.504	.604	55.572	.000	-5.689	-3.320
		[OrdinalGradeABC = .00]	-3.895	.602	41.850	.000	-5.075	-2.715
		[OrdinalGradeABC = 1.00]	-3.324	.601	30.604	.000	-4.502	-2.146
	Location	[HighSchoolVsCollegeSite=.00]	-1.834	.508	13.026	.000	-2.830	-.838
		[HighSchoolVsCollegeSite=1.00]	0[a]	.	.	.	.	.
		[CTE=.00]	.041	.281	.021	.884	-.509	.591
		[CTE=1.00]	0[a]	.	.	.	.	.
		[CIHS=.00]	.084	.099	.719	.396	-.110	.279
		[CIHS=1.00]	0[a]	.	.	.	.	.
		[Black=.00]	.328	.116	8.040	.005	.101	.555
		[Black=1.00]	0[a]	.	.	.	.	.
		[Female=.00]	-.325	.088	13.738	.000	-.497	-.153
		[Female=1.00]	0[a]	.	.	.	.	.

Link function: Complementary Log-log.

a. This parameter is set to zero because it is redundant.

Data subset – high school GPA. Only one college was able to provide high school GPA in a comprehensive manner. An ordinal regression analysis on this subset of data was run, and dependent variable frequencies are reported in Table 12.

Table 12

Final Course Grade Frequencies: Delivery Location - Data Subset

Letter Grade	Frequency	Percent
A	575	35.3
B	508	31.2
C	309	19.0
D	103	6.3
W	61	3.7
F	73	4.5
Total	1629	100.0

Model Adjustments. As illustrated in Figure 2, the data subset model had a similar distribution to the original combined delivery location data set for all colleges in the study. Higher categories of the dependent variable were more probable. Therefore, a complementary log-log model was used for the analysis of data subset as well.

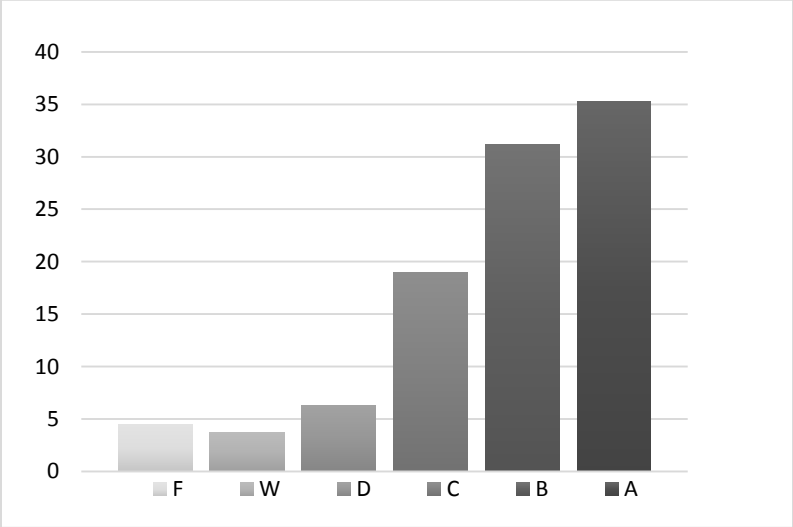

Figure 2: Distribution of Final Grades by Delivery Location Data Subset

As with the first run of the delivery location combined data set, data subset parameter estimates indicated that not all the threshold (intercept) values for the dependent variable were significant. In order to find a best-fit model, multiple iterations of the data subset were run, dropping categorical covariates one at a time and combining

some levels of the dependent variable. A new best-fit model that dropped all race variables and combined thresholds of F, W, and D produced estimates that were all significant. As indicated in Table 13, the new combined FWD threshold had a significance level of $p < 0.01$ while the other thresholds had significance levels of $p < 0.001$.

Table 13

Thresholds: Delivery Location - Data Subset FWD Model

Threshold					95% Confidence Interval	
	Estimate	Std. Error	Wald	Sig.	Lower Bound	Upper Bound
[OrdinalGradeFWD = 1.00]	.834	.316	6.965	.008	.215	1.453
[OrdinalGradeFWD = 2.00]	1.872	.315	35.440	.000	1.256	2.489
[OrdinalGradeFWD = 3.00]	2.964	.318	86.693	.000	2.340	3.588

Model fit. The overall fit of the FWD model as determined by the log likelihood ratio test was significant as reported in Table 14, indicating a well-fitting model. The Nagelkerke pseudo-R^2 was 0.267 indicating a moderate effect size for the model.

Table 14

Model Fitting Information: Delivery Location - Data Subset FWD Model

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	2854.736			
Final	2392.059	462.678	5	.000

Link function: Complementary Log-log.

Contribution of predictor variables. Weighted high school GPA was added to the subset model. College size was removed because the subset included data from a single college.

As indicated in Table 15, the independent variable of delivery location was significant as were all other categorical and continuous covariates.

Table 15

Parameter Estimates: Delivery Location - Data Subset FWD Model

Location	Estimate	Std. Error	Wald	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
HSGPA	1.113	.057	377.612	.000	1.000	1.225
[HighSchoolSite=.00]	.446	.183	5.911	.015	.086	.806
[HighSchoolSite=1.00]	0[a]	.	.	.	.	.
[CTE=.00]	-1.720	.200	73.780	.000	-2.112	-1.327
[CTE=1.00]	0[a]	.	.	.	.	.
[CIHS=.00]	-.174	.072	5.868	.015	-.316	-.033
[CIHS=1.00]	0[a]	.	.	.	.	.
[Female=.00]	-.160	.065	5.973	.015	-.288	-.032
[Female=1.00]	0[a]	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

For the independent variable of delivery location, college campus was the baseline. Taking courses at a high school site was associated with a decrease in final grades.

An increase in the continuous covariate of high school GPA was associated with an increase in final course grade. For the categorical covariate of CCP pathway type, the CTP pathway (traditional high school college transfer) was the baseline. The CTE (career and technical education) was associated with higher final course grades. To a lesser extent, the CIHS pathway (cooperative innovative high schools) was also associated with an increase in final course grades. For the covariate of gender, being female was associated with an increase in final course grade. Because the frequency distribution of

the dependent variable required the analysis to be run using a complementary log-log instead of a logit link, effect size of predictor variables could not be calculated for this data subset analysis.

Data subset – split model. Only NON-STEM courses were taught at high school sites for the data subset. Therefore, a second model splitting the dataset by course type could not be run.

Course Success by Delivery Mode

Research question two asked to what extent the delivery mode (face-to-face, hybrid, or online) of college classes taken by dual enrolled students correlated with student success as defined by final grades in those courses. The hypothesis for research question two was that course success would be statistically significantly higher for dual enrolled students taking classes delivered in face-to-face and hybrid modes compared to dual enrolled students taking classes delivered in a fully online mode.

Combined data set. The sample of records for the combined data set on delivery mode from all four colleges included a total of 19,891 records. Table 16 lists the frequency distribution for the sample.

Table 16

Final Course Grade Frequencies: Delivery Mode – Combined Data Set

Letter Grade	Frequency	Percent
A	9079	45.6
B	5121	25.7
C	2742	13.8
D	920	4.6
W	869	4.4
F	1160	5.8
Total	19891	100.0

Model Adjustments. As illustrated in Figure 3, the data for delivery mode had a similar distribution as the data for delivery location in the combined data set for all colleges in the study. Higher categories of the dependent variable were more probable. Therefore, a complementary log-log model was used for the analysis of the delivery mode dataset as well.

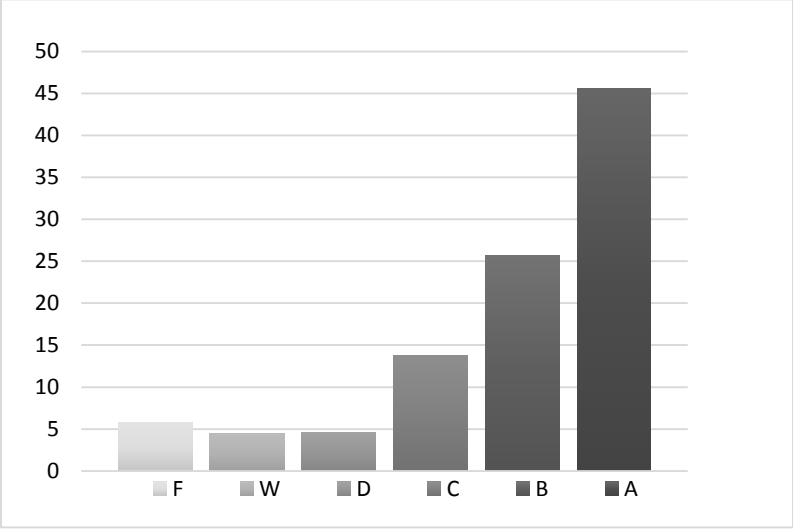

Figure 3: Distribution of Final Grades by Percent – Delivery Mode

In the first run of the complementary log-log analysis, the parameter estimates indicated that not all the threshold (intercept) values for the dependent variable were significant. As indicated in Table 17, the estimate for OrdinalGrade = 2, the equivalent of

a C letter grade, was not significant ($p = 0.603$). Non-significant thresholds indicate cutting points are not truly different, and some levels of the dependent variable should be combined (Garson, 2014).

Table 17

Thresholds: Delivery Mode Original Model – Combined Data Set

					95% Confidence Interval	
Threshold	Estimate	Std. Error	Wald	Sig.	Lower Bound	Upper Bound
[OrdinalGrade = -1.00]	-1.877	.274	46.830	.000	-2.415	-1.340
[OrdinalGrade = .00]	-1.293	.274	22.307	.000	-1.829	-.756
[OrdinalGrade = 1.00]	-.891	.273	10.614	.001	-1.427	-.355
[OrdinalGrade = 2.00]	-.142	.273	.271	.603	-.678	.393
[OrdinalGrade = 3.00]	.716	.273	6.884	.009	.181	1.252

To improve significance levels of the thresholds, several new iterations testing combinations of different levels of the dependent variable were run. A new best-fit model combining letter grades of C and B produced threshold estimates that were all significant. As indicated in Table 18, estimates for the OrdingalGradeBC model all had significance levels of $p < 0.05$.

Table 18

Thresholds: Delivery Mode BC Model – Combined Data Set

Threshold	Estimate	Std. Error	Wald	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
[OrdinalGrade = -1.00]	-1.952	.278	49.197	.000	-2.498	-1.407
[OrdinalGrade = .00]	-1.367	.278	24.251	.000	-1.911	-.823
[OrdinalGrade = 1.00]	-.965	.277	12.115	.001	-1.509	-.422
[OrdinalGrade = 2.00]	.641	.277	5.346	.021	.098	1.184

Model fit. As Table 19 indicates for the test of parallel lines, the log-likelihood statistic was significant, suggesting the model was not well-fit. However, the sample size, n = 19,891, was quite large. "Since the parallel lines test for large samples can report violation even for trivial differences in slopes, it is common in the literature to skip the test as unreliable" (Garson, location 1396).

Table 19

Test of Parallel Lines: Delivery Mode – Combined Data Set

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	4607.861			
General	4143.106	464.755	42	.000

The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.[a]

a. Link function: Complementary Log-log.

The overall fit of the model is determined by the likelihood ratio test. A well-fitting model is significant by this test (Garson, 2014). As indicated in Table 20, the log likelihood value for the intercept-only null model was significantly different from the corresponding value for the full model, indicating a well-fitting model.

Table 20

Model Fitting Information: Delivery Mode – Combined Data Set

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	5278.608			
Final	4607.861	670.747	14	.000

a. Link function: Complementary Log-log.

An additional measure of the model effect size for ordinal regression is the pseudo-R^2 statistic. The Nagelkerke pseudo-R^2 was 0.037, indicating a weak effect size for the overall model.

Contribution of predictor variables. The *z*-statistic, reported as the Wald statistic, was examined to assess whether the *b* coefficient, reported as a location parameter estimate, for predictor variables was significantly different from 0 and, therefore, whether predictors significantly contributed to the prediction of the outcome variable. As indicated in Table 21, all categorical predictors were significant except two race categories: NativeAmerican and HawaiianPacificIslander. Two race categories, (MULTI and NoneListed) had a significance level of $p < 0.05$. Two predictors (Internet and Hispanic) had a significance level of $p < 0.01$. The remaining predictors (Hybrid, CTE, CIHS, Black, Asian, Female, MediumCollege, and LargeCollege) had a significance level of $p < 0.001$.

Table 21

Parameter Estimates: Delivery Mode – Combined Data Set

Location	Estimate	Std. Error	Wald	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
[Internet=.00]	.063	.024	7.072	.008	.017	.109
[Internet=1.00]	0[a]	.	.	.	.	.
[Hybrid=.00]	.174	.031	32.274	.000	.114	.234
[Hybrid=1.00]	0[a]	.	.	.	.	.
[CTE=.00]	.309	.032	94.765	.000	.246	.371
[CTE=1.00]	0[a]	.	.	.	.	.
[CIHS=.00]	.194	.024	63.039	.000	.146	.242
[CIHS=1.00]	0[a]	.	.	.	.	.
[Black=.00]	.415	.028	215.100	.000	.360	.471
[Black=1.00]	0[a]	.	.	.	.	.
[Hispanic=.00]	.136	.044	9.630	.002	.050	.222
[Hispanic=1.00]	0[a]	.	.	.	.	.
[NativeAmerican=.00]	.130	.073	3.170	.075	-.013	.272
[NativeAmerican=1.00]	0[a]	.	.	.	.	.
[Asian=.00]	-.365	.063	33.377	.000	-.489	-.241
[Asian=1.00]	0[a]	.	.	.	.	.
[HawaiianPacificIslander=.00]	.220	.231	.912	.340	-.232	.672
[HawaiianPacificIslander=1.00]	0[a]	.	.	.	.	.
[MULTI=.00]	.097	.046	4.378	.036	.006	.188
[MULTI=1.00]	0[a]	.	.	.	.	.
[NoneListed=.00]	.104	.049	4.489	.034	.008	.200
[NoneListed=1.00]	0[a]	.	.	.	.	.
[Female=.00]	-.274	.020	190.371	.000	-.313	-.235
[Female=1.00]	0[a]	.	.	.	.	.
[MediumCollege=.00]	-.233	.030	61.379	.000	-.292	-.175
[MediumCollege=1.00]	0[a]	.	.	.	.	.
[LargeCollege=.00]	-.133	.029	20.544	.000	-.190	-.075
[LargeCollege=1.00]	0[a]	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

All categorical predictors were reported as dichotomies. Estimates were reported for the all other categories. For example, in the category of Internet, internet courses were coded as 1's, and all other delivery formats were coded as 0's. Because the estimate reported is for Internet=0, *not* taking courses in an internet mode is associated with an increase in final course grade. Or stated conversely, taking courses in an internet mode is associated with a decrease in final course grade. To understand the estimates better, it may be helpful to flip the sign of the estimate and associate it with the opposite category. For example, Internet=0 with an estimate of 0.063 is the same as Internet=1 with an estimate of -0.063.

For the independent variable of delivery location, traditional face-to-face classes was the baseline. Taking courses in an internet mode was associated with lower final grades. Interestingly, taking courses in a hybrid mode was associated with lower final grades to an even greater degree than internet.

For the covariate of CCP Pathway type, the CTP pathway (traditional high school college transfer) was the baseline. The CTE (career and technical education) was associated with lower final course grades. To a lesser extent, the CIHS pathway (cooperative innovative high schools, including early and middle colleges) was associated with a decrease in final course grade.

For the covariate of race, White was the baseline. Compared to all other races, the being Asian was associated with an increase in final course grade, and the other race categories are associated with a decrease in final course grade. For the covariate of gender, being female was associated with an increase in final course grade. For the covariate of institution size, attending a large college was associated with an increase in

final course grade, and attending a medium college was associated with an even greater increase in final course grade.

Because the frequency distribution of the dependent variable required the analysis to be run using a complementary log-log instead of a logit link, effect size of predictor variables could not be calculated for this research question either.

Combined data set – split file model. As with the combined dataset model for delivery location, a second model was run on the delivery mode data subset which split the file into course type for comparison purposes. Courses were coded as STEM (transfer courses labeled with STEM general education categories), NON-STEM (transfer courses labeled with any other general education category), or CTE (all non-transfer courses).

Model Adjustments. In the first run of the split file model, the parameter estimates indicated that not all the threshold (intercept) values for the dependent variable were significant. In order to find a best-fit model, multiple iterations of the split file were run, dropping categorical covariates one at a time and combining some levels of the dependent variable. The final split file model included course delivery mode, CCP Pathway type, and gender covariates. In addition, the thresholds for grades of A, B, and C were all combined. However, the model still did not produce significant results for the CTE course type, so those results are not presented here.

Model fit. As indicated in Table 22, the log likelihood value for the intercept-only null model was significantly different from the corresponding value for the full model for the NON and STEM categories, indicating a well-fitting model for both.

Table 22

Model Fitting Information: Delivery Mode – Split File Model

Course Type	Model	-2 Log Likelihood	Chi-Square	df	Sig.
NON	Intercept Only	621.248			
	Final	355.384	265.864	5	.000
STEM	Intercept Only	322.519			
	Final	282.851	39.667	5	.000

Link function: Complementary Log-log.

Contribution of predictor variables. As indicated in Table 23, all predictor variables were significant except for the hybrid delivery mode for STEM courses. Taking internet courses was associated with lower final grades for both STEM and NON-STEM courses, but the association was greater for NON-STEM courses. Hybrid non-STEM courses were also associated with lower course grades.

For the covariate of CCP pathway type, the CTE and CIHS pathways were associated with a decrease in final course grades for both STEM and NON-STEM courses, but the association was greater for NON-STEM courses. For the covariate of gender, being female was associated with an increase in final course grade for both STEM and non-STEM courses, but the association was greater for NON-STEM courses.

Table 23

Parameter Estimates: Delivery Mode – Split File Model

Course Type			Estimate	Std. Error	Wald	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
NON	Threshold	[OrdinalGrade ABC = -1.00]			-1.989	.000	1	.000
		[OrdinalGrade ABC = .00]	-.807	.137	34.889	.000	-1.074	-.539
		[OrdinalGrade ABC = 1.00]	-.426	.136	9.810	.002	-.692	-.159
	Location	[Hybrid=.00]	.521	.089	33.997	.000	.346	.696
		[Hybrid=1.00]	0[a]	.	.	.	.	.
		[Internet=.00]	.580	.051	129.798	.000	.481	.680
		[Internet=1.00]	0[a]	.	.	.	.	.
		[CTE=.00]	.751	.086	76.037	.000	.582	.920
		[CTE=1.00]	0[a]	.	.	.	.	.
		[CIHS=.00]	.388	.056	47.643	.000	.278	.499
		[CIHS=1.00]	0[a]	.	.	.	.	.
		[Female=.00]	-.453	.048	89.234	.000	-.547	-.359
		[Female=1.00]	0[a]	.	.	.	.	.
STEM	Threshold	[OrdinalGrade ABC = -1.00]	-1.989	.245	65.723	.000	-2.470	-1.508
		[OrdinalGrade ABC = .00]	-1.339	.241	30.854	.000	-1.811	-.866
		[OrdinalGrade ABC = 1.00]	-.814	.239	11.567	.001	-1.283	-.345
	Location	[Hybrid=.00]	.173	.097	3.188	.074	-.017	.363
		[Hybrid=1.00]	0[a]	.	.	.	.	.
		[Internet=.00]	.298	.105	8.102	.004	.093	.503
		[Internet=1.00]	0[a]	.	.	.	.	.
		[CTE=.00]	.577	.195	8.719	.003	.194	.960
		[CTE=1.00]	0[a]	.	.	.	.	.
		[CIHS=.00]	.271	.088	9.489	.002	.098	.443
		[CIHS=1.00]	0[a]	.	.	.	.	.
		[Female=.00]	-.338	.079	18.395	.000	-.493	-.184
		[Female=1.00]	0[a]	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

Data subset – high school GPA. Only one college was able to provide high school GPA in a comprehensive manner. An ordinal regression analysis on this subset of data was run, and dependent variable frequencies are reported in Table 24.

Table 24

Final Course Grade Frequencies: Delivery Mode - Data Subset

Letter Grade	Frequency	Percent
A	1522	42.8
B	963	27.1
C	545	15.3
D	186	5.2
W	171	4.8
F	166	4.7
Total	3553	100.0

Model Adjustments. As illustrated in Figure 4, the data subset model had a similar distribution as the original combined data set for all colleges in the study. Higher categories of the dependent variable were more probable. Therefore, a complementary log-log model was used for the analysis of data subset as well.

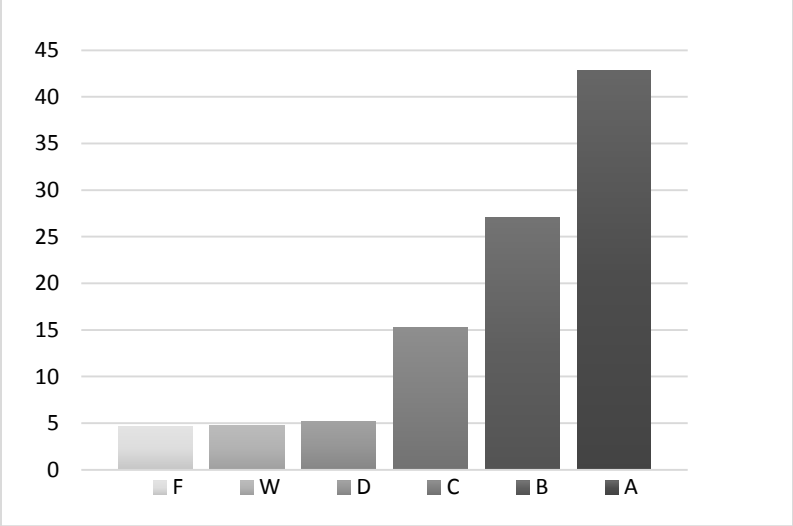

Figure 4: Distribution of Final Grades by Percent – Delivery Mode Data Subset

As with the first run of the combined data set, the data subset parameter estimates indicated that not all the threshold (intercept) values for the dependent variable were significant. To improve significance levels of the thresholds, several new iterations testing combinations of different levels of the dependent variable were run. A new best-fit model combining letter grades of F, W, and D produced threshold estimates that were all significant. As indicated in Table 25, the new combined FWD threshold model had a significance level of $p < 0.05$ while the other thresholds had significance levels of $p < 0.001$.

Table 25

Thresholds: Delivery Mode - Data Subset FWD Model

Threshold					95% Confidence Interval	
	Estimate	Std. Error	Wald	Sig.	Lower Bound	Upper Bound
[OrdinalGradeFWD = .00]	1.755	.699	6.304	.012	.385	3.126
[OrdinalGradeFWD = 1.00]	2.669	.699	14.558	.000	1.298	4.039
[OrdinalGrade FWD = 2.00]	3.689	.700	27.749	.000	2.317	5.062

Link function: Complementary Log-log.

Model fit. Due to large sample size, the parallel lines test of model fit was skipped. The overall fit of the model as determined by the log likelihood ratio test was significant as reported in Table 26, indicating a well-fitting model. The Nagelkerke pseudo-R^2 was 0.295 indicating a moderate effect size for the subset model, much higher than the 0.037 for the overall combined dataset model.

Table 26

Model Fitting Information: Delivery Mode - Data Subset FWD Model

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	6984.504			
Final	5858.997	1125.506	13	.000

Link function: Complementary Log-log.

Contribution of predictor variables. Weighted high school GPA was added to the subset model. College size was removed because the subset included data from a single college.

As indicated in Table 27, hybrid delivery mode was not significant, nor were three races: Hispanic, Native American, and Asian. All other categorical predictors were significant as was the continuous predictor of high school GPA.

Table 27

Parameter Estimates: Delivery Mode - Data Subset FWD Model

Location	Estimate	Std. Error	Wald	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
HSGPA	1.206	.042	837.792	.000	1.125	1.288
[Hybrid=.00]	.063	.076	.689	.407	-.086	.213
[Hybrid=1.00]	0[a]	.	.	.	.	.
[Internet=.00]	-.310	.050	38.461	.000	-.407	-.212
[Internet=1.00]	0[a]	.	.	.	.	.
[CTE=.00]	-1.267	.140	81.327	.000	-1.542	-.991
[CTE=1.00]	0[a]	.	.	.	.	.
[CIHS=.00]	-.223	.053	17.931	.000	-.326	-.120
[CIHS=1.00]	0[a]	.	.	.	.	.
[Black=.00]	.254	.089	8.106	.004	.079	.429
[Black=1.00]	0[a]	.	.	.	.	.
[Hispanic=.00]	.095	.116	.665	.415	-.133	.322
[Hispanic=1.00]	0[a]	.	.	.	.	.
[NativeAmerican=.00]	-.378	.328	1.332	.248	-1.021	.264
[NativeAmerican=1.00]	0[a]	.	.	.	.	.
[Asian=.00]	.029	.316	.009	.926	-.590	.648
[Asian=1.00]	0[a]	.	.	.	.	.
[HawaiianPacificIslander=.00]	1.258	.447	7.918	.005	.382	2.134
[HawaiianPacificIslander=1.00]	0[a]	.	.	.	.	.
[MULTI=.00]	-.401	.114	12.284	.000	-.626	-.177
[MULTI=1.00]	0[a]	.	.	.	.	.
[NoneListed=.00]	-.175	.083	4.448	.035	-.339	-.012
[NoneListed=1.00]	0[a]	.	.	.	.	.
[Female=.00]	-.147	.047	9.642	.002	-.239	-.054
[Female=1.00]	0[a]	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

For the independent variable of delivery mode, traditional face-to-face classes was the baseline. Taking courses in an internet mode was associated with an increase in final grades. This was the opposite from the combined dataset model.

An increase in the continuous covariate of high school GPA was associated with an increase in final course grade. For the categorical covariate of CCP Pathway type, the CTP pathway (traditional high school college transfer) was the baseline. The CTE (career and technical education) was associated with higher final course grades. To a lesser extent, the CIHS pathway (cooperative innovative high schools, including early and middle colleges) was also associated with an increase in final course grades. Both CCP Pathway type associations with final grades were opposite from the combined dataset model.

For the covariate of race, White was the baseline. Compared to all other races, being Black or Hawaiian/Pacific Islander was associated with a decrease in final course grade, consistent with the combined dataset model. Listing multiple races or no listing at all for race were both associated with an increase in final course grade, the opposite of the combined dataset model. For the covariate of gender, being female was associated with an increase in final course grade, consistent with the combined dataset model. Because the frequency distribution of the dependent variable required the analysis to be run using a complementary log-log instead of a logit link, effect size of predictor variables could not be calculated for the analysis of this subset of data.

Data subset – split file model. As with the combined dataset model, a second model was run on the data subset which split the file into course type for comparison purposes. Courses were coded as STEM (transfer courses labeled with STEM general

education categories), NON (transfer courses labeled with any other general education category), or CTE (all non-transfer courses).

Model fit. As indicated in Table 28, the log likelihood value for the intercept-only null model was significantly different from the corresponding value for the full model for the NON-STEM and STEM categories, indicating a well-fitting model for both. Consistent with the combined dataset model, this model did not produce significant results for the CTE course type, so those results are not presented here.

Table 28

Model Fitting Information: Delivery Mode – Data Subset Split File Model

Course Type	Model	-2 Log Likelihood	Chi-Square	df	Sig.
NON	Intercept Only	5109.906			
	Final	4152.986	956.920	13	.000
STEM	Intercept Only	2031.563			
	Final	1589.367	442.196	13	.000

Link function: Complementary Log-log.

Contribution of predictor variables. As indicated in Table 29, the independent variable delivery modes of hybrid and internet were significant for NON-STEM courses and were associated with higher course grades. However, only internet was significant for STEM courses and was also associated with higher course grades. This result was the opposite of the combined dataset model.

Table 29

Parameter Estimates: Delivery Mode – Data Subset Split File Model

Course Type			Estimate	Std. Error	Wald	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
NON	Threshold	[OrdinalGradeFWD = .00]	2.990	.884	11.431	.001	1.256	4.723
		[OrdinalGradeFWD = 1.00]	3.930	.885	19.727	.000	2.196	5.664
		[OrdinalGradeWD = 2.00]	4.981	.886	31.569	.000	3.243	6.718
	Location	HSGPA	1.397	.054	680.975	.000	1.292	1.502
		[Hybrid=.00]	-.590	.126	22.007	.000	-.836	-.343
		[Hybrid=1.00]	0[a]	.	.	.	.	.
		[Internet=.00]	-.471	.059	64.124	.000	-.587	-.356
		[Internet=1.00]	0[a]	.	.	.	.	.
		[CTE=.00]	-.351	.230	2.319	.128	-.803	.101
		[CTE=1.00]	0[a]	.	.	.	.	.
		[CIHS=.00]	-.363	.065	31.080	.000	-.490	-.235
		[CIHS=1.00]	0[a]	.	.	.	.	.
		[Black=.00]	.147	.103	2.032	.154	-.055	.348
		[Black=1.00]	0[a]	.	.	.	.	.
		[Hispanic=.00]	.078	.135	.336	.562	-.186	.342
		[Hispanic=1.00]	0[a]	.	.	.	.	.
		[NativeAm=.00]	.284	.388	.535	.465	-.477	1.045
		[NativeAm=1.00]	0[a]	.	.	.	.	.
		[Asian=.00]	.141	.332	.180	.672	-.509	.790
		[Asian=1.00]	0[a]	.	.	.	.	.
		[HawaiianPacific Islander=.00]	1.059	.605	3.064	.080	-.127	2.245
		[HawaiianPacific Islander=1.00]	0[a]	.	.	.	.	.
		[MULTI=.00]	-.398	.137	8.400	.004	-.667	-.129
		[MULTI=1.00]	0[a]	.	.	.	.	.
		[NoneListed=.00]	-.120	.101	1.402	.236	-.317	.078
		[NoneListed=1.00]	0[a]	.	.	.	.	.
		[Female=.00]	-.172	.057	8.964	.003	-.284	-.059

		[Female=1.00]	0[a]	.	.	.	.	.
STEM	Threshold	[OrdinalGradeFWD = .00]	5.645	1.902	8.804	.003	1.916	9.373
		[OrdinalGradeFWD = 1.00]	6.614	1.904	12.065	.001	2.882	10.346
		[OrdinalGradeFWD = 2.00]	7.816	1.909	16.753	.000	4.073	11.558
	Location	HSGPA	1.640	.094	306.711	.000	1.456	1.823
		[Hybrid=.00]	.048	.119	.165	.684	-.185	.282
		[Hybrid=1.00]	0[a]	.	.	.	.	.
		[Internet=.00]	-.705	.114	37.952	.000	-.929	-.480
		[Internet=1.00]	0[a]	.	.	.	.	.
		[CTE=.00]	-.862	.383	5.078	.024	-1.612	-.112
		[CTE=1.00]	0[a]	.	.	.	.	.
		[CIHS=.00]	-.310	.103	9.120	.003	-.511	-.109
		[CIHS=1.00]	0[a]	.	.	.	.	.
		[Black=.00]	.577	.211	7.496	.006	.164	.990
		[Black=1.00]	0[a]	.	.	.	.	.
		[Hispanic=.00]	-.117	.250	.219	.639	-.608	.373
		[Hispanic=1.00]	0[a]	.	.	.	.	.
		[NativeAm=.00]	1.545	.826	3.500	.061	-.074	3.163
		[NativeAm=1.00]	0[a]	.	.	.	.	.
		[Asian=.00]	-.402	1.144	.124	.725	-2.645	1.841
		[Asian=1.00]	0[a]	.	.	.	.	.
		[HawaiianPacific Islander=.00]	1.621	1.105	2.150	.143	-.546	3.787
		[HawaiianPacific Islander=1.00]	0[a]	.	.	.	.	.
		[MULTI=.00]	-.356	.222	2.562	.109	-.791	.080
		[MULTI=1.00]	0[a]	.	.	.	.	.
		[NoneListed=.00]	-.342	.192	3.173	.075	-.718	.034
		[NoneListed=1.00]	0[a]	.	.	.	.	.
		[Female=.00]	-.199	.095	4.398	.036	-.384	-.013
		[Female=1.00]	0[a]	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

An increase in the continuous covariate of high school GPA was associated with an increase in final course grade. For the covariate of CCP pathway type, the CTE pathway was not significant for non-STEM courses. The CTE pathway for STEM courses and the CIHS pathway for both NON-STEM and STEM courses were significant and associated with an increase in final course grades for both STEM and NON-STEM courses. This result was the opposite of the combined dataset model.

For the covariate of race, only the MULTI category was significant for non-STEM courses and was associated with higher course grades. In STEM courses, only the race category of Black was significant and was associated with lower course grades. For the covariate of gender, being female was associated with an increase in final course grade for both STEM and NON-STEM courses.

Summary

The hypothesis for research question one was that course success would be statistically significantly higher for dual enrolled students taking classes on a college campus compared to dual enrolled students taking classes on a high school site. The results from the two overall models did not support this hypothesis. In the combined data model for all four colleges, taking courses at a high school site was associated with an increase in final course grade. In a second model which split the data by course type, taking courses on a high school site was associated with higher final grades for both CTE and STEM courses, but the association was greater for STEM courses. The subset model which included data from only one college, but which accounted for high school GPA, did support the hypothesis. In this model, taking courses at a high school site was associated with a decrease in final grades.

The hypothesis for research question two was that course success would be statistically significantly higher for dual enrolled students taking classes delivered in face-to-face and hybrid modes compared to dual enrolled students taking classes delivered in a fully online mode. The results from the two overall models supported this hypothesis. Taking courses in an internet mode was associated with a decrease in final course grade. In a second model which split the data by course type, taking internet courses was associated with lower final grades for both STEM and NON-STEM courses, but the association was greater for NON-STEM courses. The subset model which included data from only one college, but which accounted for high school GPA, did support not the hypothesis. In this model, taking courses in an internet mode was associated with an increase in final grades.

Two notable results exist for demographic variables. Throughout the various study models, Black students performed lower than other students. In addition, females outperformed males. The composition of the study population and sample were quite similar for these two groups. Statewide, Black students made up 14% of the Career and College Promise population, and females made up 59% of the population (State Board of Education, 2018). In the study, Black students comprised 14.4% of the sample, and females constituted 59% of the sample.

Chapter 5 will include a discussion of the findings, implications for practice in dual enrollment programs, and recommendations for future research.

Chapter 5

Discussion

This chapter first provides context leading up to the research. Next it reiterates the purpose of the study and discusses the findings within the perspectives of previous studies and the conceptual framework of the current study. Following are the study limitations and the implications for practice. The chapter concludes with recommendations for future research.

Context

Dual enrollment programs have grown considerably since the turn of the century. Between academic years 2002-03 and 2010-11, "[d]ual credit enrollments increased by 75% from an estimated 1.16 million to 2.04 million[, and] [t]he percentage of public high schools offering dual credit courses increased from 71 to 82" (Borden et al., 2013). The National Center for Educational Statistics has not reported dual enrollment participation data for years later than 2010-11; however, IPEDS student age data suggests continued growth since then (Fink, Jenkins, & Yanagiura, 2017). North Carolina dual enrollment programs, the focus of the current study, also saw tremendous growth in recent years. From 2008-09 to 2016-17, enrollment in all North Carolina joint high school programs grew by 97%, and enrollment specifically in Cooperative and Innovative High School programs (early colleges and middle colleges) grew 258% (State Board of Education, 2018).

Funding for dual enrollment programs in North Carolina is underwritten by the state. Such dramatic growth in recent years has come with significant costs. For example, in 2016-17 alone, CIHS programs received allotments totaling $26,015,034 in

supplemental funding (State Board of Education, 2018). In addition, the state paid $4,883,563 in reimbursed tuition to four-year public and private institutions which had CIHS programs (State Board of Education, 2018). At community colleges, where the vast majority of dual enrollment programs exist in North Carolina, the cost in terms of earned FTE funding was approximately $111 million (State Board of Education, 2018). The high levels of dual enrollment costs to the state was the impetus of a legislatively mandated study of the Career and College Promise Program, including costs, student outcomes, and any recommendations on modifications to the administration and funding of the program (N.C.G.S. § G.S. 115C238.54, 2017).

As dual enrollment participation in North Carolina and across the country continues to grow, policy makers and practitioners must ensure that such programs lead to positive student outcomes for participants. Numerous studies have identified some of the long-term benefits for students with dual enrollment program participation. First-year, full-time college students with experience in dual enrollment programs have higher GPA's (Allen & Dadgar, 2012; Jones, 2014; Karp et al., 2007) and first year persistence rates than their counterparts with no dual enrollment experience (Jones, 2014; Karp et al., 2007). In addition, students with prior dual enrollment experience complete their bachelor's degrees faster than students with no dual enrollment experience (Allen & Dadgar, 2012; Ganzert, 2014; Hughes, 2016). Finally, students graduate from college at higher rates if they had experience with dual enrollment than if they had no prior experience (Ganzert, 2014; Hughes, 2016).

However, very little research exists on shorter-term dual enrolled student outcomes such as college course grades. Course grades earned in dual enrollment

programs become a part of the student's official college transcript. As such, these grades can impact a student's ability to be accepted at post-secondary institutions after graduation from high school. In addition, poor grades in dual enrollment courses can negatively affect satisfactory academic progress standards, thus impacting financial aid eligibility as an adult. Therefore, it is important to understand any factors, such as course delivery location and mode, which might improve the chances of student course-level success.

Gaps in the literature make it difficult to understand the impact of course delivery location and mode on college course success for dual enrolled populations. Some research found that community college students had higher withdrawal rates and lower grades in courses taken in an online format (Gregory, 2016; Quillen, 2011; Rosenzweig, 2012; Xu & Jaggars, 2013). However, most of the research into efficacy of online learning has focused on adult students. Very few robust studies exist on the effectiveness of online learning for K-12 public school students (Means et al., 2010). In addition, almost no research has been done on the relationship of course delivery location with course success for dual enrolled students. The limited research that does exist was narrow in scope and produced results that were either statistically insignificant, were somewhat inconclusive, or which have not been replicated (Arnold et al., 2017; Flores, 2012). The current study sought to help fill in gaps in and contribute to the existing literature on course success of dual enrolled students.

Purpose Statement and Research Questions

The purpose of this study was to examine the correlation between the course delivery location (high school or college campus) for face-to-face college classes taken

by dual enrolled students in North Carolina to their success as defined by final grades in those courses. In addition, this study examined the correlation between course delivery mode (face-to-face, hybrid, or online) for college classes taken by dual enrolled students in North Carolina to student success as defined by final grades in those courses.

The study addressed the following research questions:

1. To what extent does course delivery location (high school or college campus) for college classes taken by dual enrolled students correlate with student success as defined by final grades in those courses?

2. To what extent does delivery mode (face-to-face, hybrid, or online) of college classes taken by dual enrolled students correlate with student success as defined by final grades in those courses?

Course Success by Delivery Location

The current study found that dual enrolled students were likely to have higher grades in face-to-face classes if they took them on the high school site instead of the college campus. Few prior studies examined the impact of delivery location on course grades for dual enrollment students. Furthermore, the results of these studies have been inconclusive. Flores (2012) found no statistical significance in English and mathematics course grades between high school and college sites. Arnold et al. (2017) found no statistical significance in biology and history grades between high school and college sites. However, the results were significant for English and mathematics courses. Dual enrolled students taking those courses on the college campus had lower course grades than students taking the same course on high school sites (Arnold et al., 2017). The

findings from the current study are consistent with the statistically significant results of that study.

However, the current findings did not support the hypothesis that students would perform better on the college campus due to experiencing anticipatory socialization. First developed by sociologist Robert Merton (1968), anticipatory socialization theory states that individuals who aspire to become member members of a group will find greater success when they are able to observe and adopt the attitudes and the values of the group to which they aspire. Previous studies applying the theory to dual enrollment populations focused on more long term outcomes, such as persistence in college (Pascarella et al., 1986), and bachelor's degree attainment and time to degree completion (Hughes, 2016). The current study sought to apply the theory to shorter-term outcomes, specifically final course grades.

If dual enrolled students experience less socialization to college while taking courses on the high school site yet still have higher course grades than students taking classes on the college site, then some other mechanism or mechanisms must be at play. While focusing on self-efficacy and not final course grades, Wallace (2017) found differences in in dual enrollment populations attributable to delivery location. In applying the literature to the discussion of his study results, he found several potential benefits to taking college classes on high school sites. Previous studies (An & Taylor, 2015; Karp, 2012; Pyzdrowski, Butler, Walker, Pyzdrowski, & Mays, 2011) found that "a slower paced calendar, being surrounded by peers, having access to positive role models, knowing how to advocate for themselves, and being in a familiar place where they have a history of past successes" could all help improve dual enrolled student self-efficacy (as

cited in Wallace, 2017, p. 98). Because self-efficacy has a direct effect on academic performance (Zimmerman & Cleary, 2006), improved self-efficacy due to high school location could play a role in students achieving higher final course grades in classes taken on high school sites as opposed to college campuses.

The results of a split file model were mostly consistent with the overall model. Taking both CTE and STEM course on a high school site was associated with higher course grades. The findings were not statistically significant for NON-STEM courses.

The results of a subset model in the current study, however, were not consistent with the overall findings. In the subset model which utilized data from only one community college, taking courses course on a high school site was associated with lower course grades. The findings of the subset model are congruent with previous application of anticipatory socialization theory to high school populations. The current study results suggest that shorter term socialization can also have a positive impact on success. Dual enrolled students who had more contact with the reference group, traditional students, due to routine interaction in face-to-face classes were more successful than students who took classes on the high school site. However, this finding could have been impacted by a limited data set. In the subset model, only history courses were taught on the high school site.

Covariates. In addition to the primary predictor variable of course delivery mode, the study examined a number of covariates. The findings indicated that several were statistically significant predictors of success for dual enrolled students.

Demographics. The results of the overall model which examined course level student success by delivery mode indicated that three race categories were significant

predictors. Asians were more likely to be successful than other races while Blacks and multi-racial students were more likely to be less successful than other races. These findings were consistent with a study of racial and ethnic educational achievement gaps (Kao & Thompson, 2003). In addition, females were more likely to be successful than males. This finding was consistent with the results of a meta-analysis, which summarized findings of studies pertaining to gender differences and scholastic achievement and showed that females outperform males in terms of grades in all fields of study (Voyer & Voyer, 2014).

Dual Enrollment Pathway Type. The Career and College Promise program offers three distinct pathway types: College Transfer (CTP), Career and Technical Education (CTE), and Cooperative Innovative High School programs (CIHS). Each pathway type follows different student eligibility guidelines. CTP students must have a weighted GPA of 3.0 on high school courses and demonstrate college readiness via an approved diagnostic assessment test (State Board of Community Colleges, 2017). CTE students must also have a 3.0 on high school courses; however, this requirement can be waived by recommendation of the high school principal or his or her designee. CTE students are not required to take a diagnostic assessment test. CIHS students are not required to have a 3.0 high school GPA, nor do they have to take the diagnostic assessment test. From a prior academic ability lens, one would expect the CTP students to perform better than the other two groups, given the more stringent eligibility requirements. The findings of the current study were consistent with this expectation in that both the CTE and CIHS pathway types were associated with a decrease in final course grades.

College Size. College size was a significant predictor of final course grade. Dual enrolled students at medium size colleges in the study were more likely to have higher final course grades than those at the small college. The result for large colleges was not statistically significant. Because college size in the study was based on FTE enrollment numbers, larger colleges receive more FTE funding than smaller colleges. Therefore, it is likely that small colleges receive less funding than medium and large colleges to support technical and human resources needs of distance education programs. In addition, it is likely that small colleges receive less funding than medium and large colleges to support dual enrollment programs in general. However, caution should be used with this interpretation. No per student spending data were considered in this study.

Course Success by Delivery Mode

The current study found dual enrolled students were more likely to have higher final grades taking courses face-to-face rather than via internet delivery. The findings are consistent with prior studies which examined community college student success by delivery mode. Smaller scale studies found that community college students had higher withdrawal rates and lower grades in courses taken in an online format (Gregory, 2016; Quillen, 2011; Rosenzweig, 2012). A more comprehensive, statewide study found similar results (Xu & Jaggars, 2013). These previous studies did not focus on dual enrolled students. The current study suggests that high school populations are not different from adult populations in regard to the negative impact of taking courses online.

The current findings are also congruent with previous application of anticipatory socialization theory to high school populations. The current study results suggest that shorter term socialization can also have a positive impact on success. Dual enrolled

students who had more contact with the reference group, traditional students, due to routine interaction in face-to-face classes were more successful than students who took internet classes. Because the face-to-face course dataset also included classes taken on high school sites, the self-efficacy elements previously discussed could have played a role in the success of some students taking face-to-face classes.

The results of a split file model were consistent with the overall model. Taking both STEM and NON-STEM courses in an online format was associated with lower final course grades.

The results of a subset model in the current study, however, were not consistent with the overall findings or with the previous studies. In the subset model which utilized data from only one community college, taking courses in an internet mode was associated with higher final course grades. This finding suggests that course success as predicted by delivery mode is impacted by more than just the degree of anticipatory socialization occurring. It is likely that course quality and amount of instructor interaction in online courses play an important role in student success. The current study did not, however, control for these variables.

Covariates. In addition to the primary predictor variable of course delivery mode, the study examined a number of covariates. The findings indicated that several were statistically significant predictors of success for dual enrolled students.

Demographics. The results of the overall model which examined course level student success by delivery mode indicated that two race categories were significant predictors. Asians were more likely to be successful than other races while Blacks were more likely to be less successful than other races. These findings were consistent with a

study of over 500,000 community college courses which examined performance gaps between online and face-to-face courses and considered race and gender demographics (Xu & Jaggars, 2014). In addition, females were more likely to be successful than males. This finding was also consistent with Xu and Jaggars (2014) examination of success in online courses and was consistent with Voyer and Voyer's (2014) gender study.

Dual Enrollment Pathway Type. Dual enrollment pathway type was significant for delivery mode as well. Just as in the results of the delivery location section, the CTE and CIHS pathway types were associated with a decrease in final course grades. This result is consistent with expectations, given the eligibility requirements previously outlined.

College Size. College size was a significant predictor of final course grade for this research question as well. Dual enrolled students at the smaller college in the study were more likely to have lower final course grades than those at medium or large colleges. The same funding implications and caution in that interpretation apply here as did for the findings on delivery location.

Limitations

Several limitations exist for the present study. As discussed in Chapter 3, an internal validity limitation surrounds the study design. Because this was an *ex post facto* study, it did not incorporate a true experimental design. Therefore, connections between predictor and outcome variables can only be discussed in terms of correlation. No cause and effect conclusions can be drawn.

Lack of generalizability is an external validity limitation of the study. Although Career and College Promise is a statewide program with a clear set of operating

procedures, course delivery is not regulated by system wide policies. Data collection procedures in this study revealed that variability exists across the participating institutions, both in how dual enrollment programs were implemented and how data were reported. Therefore, the results of the present study may not be generalizable across the entire North Carolina Community College system. In addition, dual enrollment policies vary by state in terms of transferability of credits, program funding, quality control processes, and student eligibility requirements (Zinth, 2016). The present study did not control for such policy elements, so the results may not be generalizable to other states, especially those with disparate dual enrollment policy elements.

Another limitation exists for the implementation of the study. The methodology called for controlling for high school GPA as a measure of prior academic ability. However, only one of the four participant colleges was able to provide those data. An attempt was made to compensate for this lack of covariate data by including placement test scores, but the same lack of reporting problem existed for that as well. Analysis of a data subset including only records from the college which provided high school GPA data indicated results contrary to the overall combined dataset. However, the research design did not allow for inferences to be made about whether this finding was a result of inclusion of this covariate or if it was due to institutional differences in the dual enrollment program.

A final limitation of the study lies in the statistical analysis. Originally, the ordinal regression analysis called for the use of a logit link function. A complementary log-log model is recommended, however, when higher categories of the dependent ordinal variable are more likely (Garson, 2014), which was the case for this study. While pseudo-

R^2 statistics allowed for estimates of effect size for the overall models, effect sizes for predictor variables could not be calculated because the odds ratios used for this purpose in ordinal regression analysis cannot be computed for complementary log-log models.

Implications for Practice

The present study indicated that, as a whole, dual enrolled students who take college classes on high school sites do not perform more poorly than students who take classes on college campuses. This may help alleviate some stakeholder concerns surrounding quality and rigor of courses delivered at high schools. College and high school administrators can feel confident in scheduling courses at high school sites as long as structured plans to ensure quality and rigor exist.

For several years, institutions of higher learning across the country have adopted rigor control measures through voluntary accreditation from the National Alliance of Concurrent Enrollment Partnerships (NACEP) (Scheffel, McLemore, & Lowe, 2015). However, this accreditation has only applied to concurrent enrollment models, which differ from other dual enrollment models in that the courses are taught by high school instructors rather than college instructors. Understanding that other dual enrollment models are growing across the country, NACEP has recently begun to develop accreditation standards that align with standards set by regional accreditation bodies for those models as well (Edds-Ellis, Little, & Lowe, 2017). With such rigor and quality control measures available and with data that support student success on high school sites, practitioners who ensure comparable course rigor at all locations can expect to see similar levels of student success between students taking classes on high school and college sites. To that end, administrators should consider membership in NACEP and

apply NACEP standards to courses taught at high school sites.

The present study also indicated that, as a whole, dual enrolled students who take courses in an internet mode performed worse that students taking classes in face-to-face or hybrid modes. However, it would be impractical to eliminate distance education models from dual enrollment programs. Seat time required for students in both high school and college classes is prohibitive for students who live in geographically remote areas that require significant travel time to college campuses.

Several strategies exist to help improve student performance in online courses. First, dual enrollment higher education partner institutions should develop an online readiness assessment rubric. As a part of the advising process, high school and college staff should use the rubric to help gauge students' fit for online learning in areas such as technological and time management skills, access to required technology (both at the high school campus and at home), and amount of time available in students' schedules to devote to taking courses in an online format. Advisors should recommend that low-scoring students not take online courses until they improve the various rubric categories to create a better fit opportunity for success in online courses.

Second, course design should be examined in low performing online courses. An increasingly popular strategy in this area is the application of standards developed by Quality Matters, an online program assurance entity. Student learning measures and completion rates have been higher in online courses which have incorporated design elements to meet Quality Matters standards (Bogle, Cook, Day, & Swan, 2009; Dietz-Uhler, Fisher, & Han, 2007). Distance education administrators at the institution level should apply Quality Matters rubrics to online course design as part of course success

measures.

Next, alternatives to asynchronous, online course delivery should be explored. In synchronous, videoconferencing formats such as WebEx and Adobe Connect, students interact directly with the teacher and with students at other locations in real time. Jaggars and Xu (2016) found that level of interpersonal interaction in distance education courses was a significant predictor of student success as defined by course grades. Synchronous distance education formats combine the convenience of remote access with much greater interpersonal interaction than asynchronous delivery platforms such as Blackboard or Moodle. Administrators should explore the feasibility of adopting such platforms at their institutions as a complement to existing to asynchronous delivery modes.

Finally, the present study indicated that, after controlling for high school GPA, CIHS students out performed traditional high school CCP students, suggesting that programmatic interventions are working at CIHS institutions. The North Carolina Legislature should, therefore, adopt recommendations made by the Joint Advisory Committee in its February 2018 Report to the General Assembly. Recommendations included the continued supplemental funding of CIHS program costs: college textbooks, essential staffing, and professional development (State Board of Education, 2018).

Recommendations for Further Research

For future study, several recommendations should be considered. One recommendation would be to replicate the study and include all community colleges in North Carolina. Although the present study included thousands of records, the four community colleges included accounted for less than seven percent of schools in the North Carolina Community College System. While the state operating procedures are

consistent across all 58 member schools, the difficulty found during this study in obtaining data for all variables at the four colleges studied indicated that data reporting practices, including confirmation of student eligibility for the Career and College Promise (CCP) program, vary across the state. A more comprehensive study of CCP colleges, including consistent data reporting mechanisms, is warranted.

Another replication study might include a cross section of colleges from various states. States have wide variability of policy in terms of student eligibility, funding, transferability of credits, and instructor/course quality and rigor components (Zinth, 2016). With 82% of high schools offering some type of dual enrollment program (Thomas et al., 2013), the nearly ubiquitous nature of dual enrollment suggests the need for more of a national study on the success rates of students by delivery mode and location. This study should attempt to control for the previously mentioned policy components.

Future research is also needed to address best practices in distance education for community colleges, specifically for the dual enrollment population. The present study indicated that, overall, students taking classes via the internet had lower final course grades than those taking classes in a fully face-to-face or hybrid format. However, a subset model of one college showed the opposite to be true. A best practices study could identify which schools had students performing better in a distance education format and then identify common practices and course design elements among high performing schools.

Educational practices at Cooperative Innovative High Schools (CIHS) should also receive further research. The overall model of the present study indicated a decrease in

final course grades for CIHS students relative to traditional high school students. This result could be attributed to measures of prior ability, such as GPA and placement test scores, that traditional high school students must meet but which CIHS students are not required to meet. However, in the subset models, which included only one college, CIHS students performed higher on course grades compared to traditional high school students. The CIHS program in this subset model received the N.C. New Schools Breakthrough Learning School of Innovation and Excellence Award for the 2014-15 school year for high student performance. Research should address which program design factors are significant predictors of student success for this CIHS and others like it.

Finally, more research may be needed connecting self-efficacy to course level success for dual enrollment populations. The present study hypothesized that students taking classes on college campuses would experience greater anticipatory socialization and, therefore, have higher final course grades than students who took classes on high school sites. With the exception of one data subset model, the results of this study did not support that hypothesis. It is possible that students taking classes on a high school site experience greater contributors to self-efficacy than those who are dispersed throughout classes on the college campus.

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Appendix

Human Subjects Exempt Research Letter

OLD DOMINION UNIVERSITY

OFFICE OF THE VICE PRESIDENT FOR RESEARCH

aacsb INTERNATIONAL
PROUDLY AN AACSB ACCREDITED PROGRAM

Physical Address
4111 Monarch Way, Suite 203
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Mailing Address
Office of Research
1 Old Dominion University
Norfolk, Virginia 23529
Phone(757) 683-3460
Fax(757) 683-5902

DATE:	August 31, 2017
TO:	Mitchell Williams
FROM:	Old Dominion University Education Human Subjects Review Committee
PROJECT TITLE:	[1117812-1] The Relationship Between Course Delivery Mode and Location with Course Success for Dual Enrolled Students
REFERENCE #:	
SUBMISSION TYPE:	New Project
ACTION:	DETERMINATION OF EXEMPT STATUS
DECISION DATE:	August 31, 2017
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.

Vita

Dean Morris Roughton

Education

- Ph.D., Community College Leadership, Old Dominion University, May 2018
- M.A., English, North Carolina State University, 2000
- B.A., English, University of North Carolina at Chapel Hill, 1997

Professional Experience

- Dean of Arts and Sciences and Secondary Education, College of The Albemarle, Aug. 2014-Current
- Division Chair of Arts and Sciences, College of The Albemarle, 2012-2014
- Department Chair for Languages and Literature, College of The Albemarle, 2007-2012
- Instructor of English, College of The Albemarle, 2006-2012
- Instructor of English, Central Carolina Community College, 2003-2006
- Instructor of English, Southeastern Community College, 2002-2003
- Adjunct Faculty, Horry-Georgetown Technical College, Jan. 2001-May 2001
- Special Lecturer, Oakland University, Aug. 2000-Dec. 2000

Professional Service

- College of The Albemarle Liaison, North Carolina Global Distinction Program with UNC World View, 2017-Current
- Proposal Reviewer for National Alliance of Concurrent Enrollment Partnerships (NACEP) National Conference, 2017
- Liaison, College of The Albemarle Strategic Planning Team, 2015-Current
- College of The Albemarle SACS Leadership Team, 2008-Current
- Chair, College of The Albemarle General Education Competencies Committee, 2008-2012

Professional Presentations and Publications

- Roughton, D.M. (April 2018). *The Relationship Between Course Delivery Mode and Location with Course Success for Dual Enrolled Students*
- Roughton, D. M., and Marsh, C. C. (Dec. 2017). *A Qualitative Approach to Continuous Improvement in Academic Support.* Presented at the 2017 SACSCOC Annual Meeting, Dallas, TX

- Williams, A., Prutsman, M., Almquist, K., & Roughton, D. (Oct. 2017). *Big Ideas Session: Pathways.* Presented at the 2017 NACEP National Conference, Washington, DC
- Roughton, D. M. (2016). Addressing college access and success gaps in traditionally underrepresented populations: The North Carolina early college high school model. *Academic Perspectives in Higher Education*: *2*(4) Retrieved from http://digitalcommons.odu.edu/aphe/vol2/iss1/4
- Carter, E., & Roughton, D. M. (Sep. 2015). *Closing the Loop on Assessment: Improvements that Transform Student Learning.* Presented at the Annual Conference on Teaching and Learning Assessment at Drexel University, Philadelphia, PA
- Carter, E., & Roughton, D. M. (Oct. 2014). *Fast Track Your SLOs*. Presented at the North Carolina Community College System Biennial Conference, Raleigh, NC

Honors and Awards

- Fulbright Scholar, 2018
- Old Dominion University Graduate Fellowship recipient, 2016
- Golden Key International Honour Society, 2015-2018
- College of The Albemarle Staff Person of the Year, 2014-15
- College of The Albemarle Excellence Award, 2014-15
- College of The Albemarle Excellence Award, 2013-14
- College of The Albemarle Service Award, 2008-2009
- College of The Albemarle Innovative Teaching Award, 2007-2008
- NC State University Outstanding Teaching Assistant Award, 1999-2000