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The influence of dual enrollment on rural student college persistence.

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THE INFLUENCE OF DUAL ENROLLMENT ON RURAL STUDENT COLLEGE PERSISTENCE

By

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B.A., Louisiana State University, 1990
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DEDICATION

First and foremost, I dedicate this dissertation to God who set my path before I even knew it. Second, I dedicate this dissertation to my ancestors who worked hard to make my life better. It is through their prayers that this journey is now complete.

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ABSTRACT

THE INFLUENCE OF DUAL ENROLLMENT ON
RURAL STUDENT COLLEGE PERSISTENCE

Jeanne Touré Guerrero

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Using the High School Longitudinal Study of 2009 (HSLS:09), this study addresses the research question of whether dual enrollment (DE) influences first- to third-year college persistence at a four-year institution, controlling for gender, race/ethnicity, socioeconomic status (SES), and rurality. The results revealed that there are statistically significant differences between the independent variables of DE Participation, Gender, Race/Ethnicity, SES, and Rurality and the dependent variable of College Persistence. Controlling for other variables, the following main effects results emerged: Students participating in DE courses were more likely to persist than non-DE students. Female DE students were more likely to persist when compared to male DE students. Black/African American students had a slightly higher likelihood of persisting than Hispanic or more than one race DE students even though minority students had a lower likelihood to persist than Asian or White students. Though low-SES DE students were less likely to persist when compared to middle or high-SES DE students, low-SES had the greatest moderating effects on DE participation and college persistence. DE students who took courses in a suburb or city were more likely to persist when compared to DE students who took courses in a town or rural location. However, DE students who took courses in a town were less likely to persist as compared to DE students who took courses in a rural

area. These findings shed light on the effects of DE student participation with other controlling factors that have implications on rural student postsecondary enrollment, persistence, and completion.

Keywords: dual enrollment, college persistence, rural students

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CHAPTER ONE

INTRODUCTION

Although rural students graduate from high school at rates higher than the national average, fewer students attend college right after high school and are more likely to drop out as compared to their nonrural peers (Wells, Manly, Kommers, & Kimball, 2019). For these students, however, several unique challenges make considering postsecondary education a difficult choice. Students who grow up in rural areas tend to have strong connections to their community, and many choose to remain close to home despite school counselors and teachers who urge high-achieving students to pursue college and job opportunities elsewhere (Byun, Irvin, & Meece, 2012; Howley, 2006; Petrin, Schafft, & Meece, 2014; Wells et al., 2019). With research suggesting that educational attainment is highly correlated with measures of economic prosperity, rural counties with the lowest levels of educational attainment face higher poverty, unemployment, and population loss than other rural counties (U.S. Department of Agriculture, 2017). Regardless, parents may discourage their children from pursuing postsecondary education away from home for fear that they might leave and never return. Consequently, students may pursue more limited educational opportunities nearby, rather than move away from their rural homes (Byun, Irvin, & Meece, 2015; Petrin et al., 2014). Thus, understanding how rural areas influence student college persistence and degree completion is complicated and must account for multiple factors that may even conflict with one another.

Research suggests that geographic location and family socioeconomic statuses (SES) are two of the most powerful determinants of students' college attendance and completion (Storer, Mienko, Chang, & Kang, 2012). In rural areas, massive economic shifts from agriculture, mining, and forestry to manufacturing, service, and automated industries have left higher rates of unemployment, poverty, and isolation among rural citizens as compared to those living in urban and suburban areas. Several studies have documented that students from rural, low-income families are less likely than students from more affluent families to complete high school and attend college (Byun et al., 2012; Demi, Coleman-Jensen, & Snyder, 2010; Koricich, Chen, & Hughes, 2018). For those rural students who do complete high school and enroll in college, research suggests that they are less likely to persist in college and attain a degree as compared to their nonrural peers (Wells et al., 2019). Although researchers have not found that living in rural environments is directly correlated with lower college aspirations and degree attainment, there is evidence to support that completing advanced academic coursework in high school is more important to college achievement than family relationships, SES, or geographic location (e.g., Adelman, 1999, 2006; Byun et al., 2015). As a result, educators and policymakers across the U.S. have increasingly encouraged participation in precollege programs such as Dual Enrollment (DE), to raise college awareness, persistence, and degree completion (Zinth, 2015).

High school dual enrollment, also known as "dual credit," or "concurrent enrollment," among other terms, refers to high school students taking college courses at public and private two- and four-year postsecondary institutions. Participating students take DE courses through a variety of delivery modes including at a community college or

four-year institution, with a high school teacher or college professor, before, during, or after school, on a college campus, at their high school, or online. Dual credit and concurrent enrollment generally refer to programs in which students earn high school and college credit simultaneously. Students taking DE courses may receive college credit but not necessarily high school credit. While differences are depending on the program and instruction, students enrolled in these programs typically receive college credit for passing these courses (Tobolowsky & Ozuna Allen, 2016). Despite these widely used definitions, DE is frequently used interchangeably with dual credit and concurrent enrollment as terminology remains inconsistent across participating institutions and states (Hoffman, Vargas, & Santos, 2009; Miller, Kosiewicz, Wang, Marwah, Delhommer, & Daugherty, 2017; Spencer & Maldonado, 2021; Zinth & Barnett, 2018). For this study, however, DE encompasses dual credit and concurrent enrollment course offerings. DE refers to pathways, programs, and opportunities that enable high school students to take college-credit courses while still enrolled in high school and receive college credit upon successful completion.

DE programs are similar to other credit-based transition to college programs, such as Advanced Placement (AP) and International Baccalaureate (IB) programs, in that they provide rigorous course work and college preparation for students. In these programs, students can earn college credits before graduating from high school. DE programs, however, allow students to receive college credit by receiving a passing grade in the course rather than taking an end-of-the-year test. Multiple studies have included DE as one of the most common factors related to increased student college preparation, persistence, and degree completion. Research indicates that students who participated in

DE courses have higher grade point averages (GPAs), improved postsecondary persistence, were more likely to obtain a college degree, and accumulated less debt as compared to students who did not participate in DE (e.g., Blankenberger, Lichtenberger, & Witt, 2017; Cowan & Goldhaber, 2015). Furthermore, rural high school students who participate in advanced DE math and science courses, gain early exposure to challenging courses and can better understand the requirements to enter STEM majors and fields once they begin college (Ihrig, Lane, Mahatmya, & Assouline, 2018). Notably, rural schools and school districts are more likely to offer DE instead of AP or IB, according to the 2015-16 U.S. Department of Education Civil Rights Data Collection. Yet, national reports indicate that rural students have less access to DE courses because of challenges such as geographic isolation, the lack of qualified teachers, and limited school budgets (Johnson & Zoellner, 2016; Sage & Sherman, 2014; Tieken, 2014). Even though many state and local policies advocate increasing DE courses in schools, administrative and program costs for schools, students, and their families pose additional obstacles. As educators continue to struggle with the issue of how to successfully transition students from high school to college, this research is important because it expands upon the existing literature related to DE, college persistence, and the rural student.

Conceptual Framework: College Student Persistence

The conceptual framework that guides this study is adapted from Vincent Tinto's 1997 *Classroom as Communities* Student Integration Model (SIM), which presented a theory of student persistence that describes the influences of precollege attributes and linked them to the classroom, student effort, and postsecondary college persistence. Broadly, Tinto's model argued that individual departure from postsecondary institutions

arises during a longitudinal process that includes interactions between a student with certain background characteristics, classroom experiences, educational commitment, and interactions that support whether a student continues their education or drops out before completion. Tinto proposed that the stronger a student's level of social and academic integration within a classroom, the greater the student's commitment to a postsecondary institution and the goal of graduation (Tinto, 1975, 1987, 1997). He postulated that although the student experience outside the classroom (e.g., home environment, work situation, etc.) may be fraught with challenges, the student experience within the classroom can be modified to directly affect student learning and persistence (Tinto, 1997). Prior research pointed to college students who report higher levels of contact with peers and faculty demonstrate higher levels of learning, which leads to stronger school commitment and the likelihood of degree attainment (Pascarella & Terenzini, 1980; Terenzini & Pascarella, 1977). Subsequent research has similarly highlighted college student academic and social integration as crucial to increasing the likelihood that a student will persist and attain a degree (e.g., Astin, 1984; Endo & Harpel, 1982; Johnson & Stage, 2018). Yet few studies have used Tinto's theories to examine the influence of the high school classroom, particularly the DE classroom, and its' relationship to college persistence and degree completion (Berger, Turk-Bicakci, Garet, Song, Knudson, Haxton, Zeiser, Hoshen, Ford, Stephan, Keating, & Cassidy, 2013; Edmunds, Unlu, Glennie, Bernstein, Fesler, Furey, & Arshavsky, 2017). Moreover, studies that investigate the DE high school classroom in a rural environment are virtually nonexistent. Therefore, I have adapted the Tinto (1997) SIM on the college classroom to expand upon

existing literature and explore the linkages between participating in high school DE courses within a rural high school DE environment and college student persistence.

Purpose of this Study

The purpose of this study is to examine the effects of participation in high school DE courses on first- to third-year college persistence at postsecondary institutions after controlling for gender, race/ethnicity, SES, and rurality. Data from the National Center for Education Statistics (NCES) HSLS:09 was used to measure the relationship of DE on the likelihood of first- to third-year student college persistence.

Existing research supports the idea that students who participate in high school DE courses have increased likelihoods of persisting in college and completing a degree; therefore, DE was included as a predictor variable in this research (e.g., Cowan et al., 2015; Blankenberger et al., 2017; Taylor & Yan, 2018). Persistence as related to first- to third-year college students was included as an outcome variable because it is a close correlate to degree attainment (Azmitia, Sumabat-Estrada, Cheong, & Covarrubias, 2018; Lewine, Manley, Bailey, Warnecke, Davis, & Sommers, 2019; Toutkoushian, May-Trifiletti, & Clayton, 2019). The sociodemographic factors of gender, race/ethnicity, SES, and rurality are used as main and moderator effect variables to explore whether there are statistically significant differences between DE participation and college persistence based upon demographics or geographic location (Byun, Meece, & Agger, 2017; Cosby, McDoom-Echebiri, James, Khandekar, Brown, & Hanna, 2019). Although research on DE programs as related to college persistence and degree completion has been increasing in recent years, the literature on DE and postsecondary educational persistence is still limited (e.g., Hunter & Wilson, 2019; Pierson, Hodara, & Luke, 2017). Further, the

literature on DE, college persistence, and rurality is almost nonexistent.

Research Question and Hypotheses

The following research question guides this study:

To what extent does dual enrollment influence first- to third-year college persistence, controlling for gender, race/ethnicity, socioeconomic status, and rurality?

The null hypothesis is as follows:

There is not a statistically significant difference in first- to third-year college persistence between students who participate in dual enrollment and students who participate in other college credit courses, after controlling for gender, race/ethnicity, socioeconomic status, and rurality.

The alternative hypothesis is as follows:

There is a statistically significant difference in first- to third-year college persistence between students who participate in dual enrollment and students who participate in other college credit courses, after controlling for gender, race/ethnicity, socioeconomic status, and rurality.

Significance of the Study

Increasingly, student success in college is gauged by retention and persistence to graduation rates. Understanding the factors that influence student success can assist educators and policy makers in terms of programming and institutional investments, particularly in regards to DE. Most of the existing literature on DE is focused on college enrollment rather than college persistence, two-year rather than four-year colleges, and single DE programs or institutions rather than a national scope (e.g., Hunter et al., 2019; Pierson, et al., 2017). This study is significant because it uses the national HSLS:09 data

to evaluate DE and the sociodemographic (e.g., gender, race/ethnicity, SES, and rurality) factors that lead to student persistence toward college completion in a four-year institution.

While most studies focus on first-year student retention, less is known about third-year student persistence. Research that tests theories of long-term retention behavior is limited by both the difficulty in tracking students in and out of institutions and by the lack of comprehensive predictive models (Pascarella & Terenzini, 2005). However, several authors suggest that long-term persistence to degree completion is a growing trend that has not been adequately accounted for in the retention literature and needs more attention (e.g., Witteveen & Attewell, 2021). This study adds to the literature on the influence of DE by examining first- to third-year enrollment status rather than first- to second-year retention to provide a more comprehensive understanding of college persistence to degree completion.

The results from this research have implications for multiple educational stakeholders. For K-12 schools and postsecondary institutions, DE courses and programs are often viewed as potential pathways to bridge students from high school to college. As all levels of educational organizations struggle with deciding how to allocate funding, this study can add to the literature on understanding DE's short-term and long-term effectiveness toward student college persistence. For policymakers and educators, the results from this study can provide information on whether DE improves educational outcomes, especially for rural students who are underrepresented in higher education. And finally, for students and their families, this research can help them decide whether the time and money invested in DE course or program participation are well spent.

Definition of Key Terms

Below are the definitions of terms relevant to this study. Some of the terms applied/referenced throughout this study are either unique to DE or defined distinctively.

Advanced Placement (AP): AP indicates a program of courses developed by the College Board to prepare high school students to take AP exams in a specific subject that may allow them to receive college credit for the corresponding course. Earning college credit for AP depends upon the college, but many U.S. colleges and universities accept AP scores.

College Persistence: College persistence, as defined by this study, refers to continuous enrollment from the beginning of the first academic year of college to the spring of the third academic year. The term "Did not persist" is used to describe students who have decided not to return to a specific university or continue for any reason and withdrew from the university.

Degree Attainment/Completion: Degree attainment/completion refers to the highest level of education completed. For this study, the term is defined as earning an associate's degree or higher.

Dual Enrollment (DE): Dual enrollment refers to a college course whereby a high school student enrolls and may receive college credit upon successful completion of the course. These courses may be taught by a certified high school teacher or a college instructor at the high school or college campus. Other terms used to describe DE include concurrent enrollment, dual credit, articulated credit, and co-enrollment. In this study, DE defines all courses that enable high school students to take college-credit courses while still enrolled in high school and receive college credit on successful completion.

Dual Enrollment Program: Dual enrollment program refers to a partnership agreement between a secondary and a postsecondary institution that allows high school students to enroll in college courses before high school completion. A high school student may enroll in a college course without being in a DE program, but this study defines a DE program as a student who participates in a DE course (s) through their high school.

High School Longitudinal Study (HSLS:09): HSLS:09 is a nationally representative longitudinal study from the NCES of more than 25,000 students from 944 schools who began Grade 9 in 2009. Follow-up surveys were administered to the student cohorts in 2012, 2013, and 2016. A final survey is scheduled for 2025. This data enables the HSLS:09 to follow students from the beginning of high school through postsecondary education and beyond.

International Baccalaureate (IB): International baccalaureate refers to a high school curriculum that includes college courses approved by the International Baccalaureate organization. Like AP, students enrolled in IB courses may earn college credit by taking an end-of-course exam.

Precollege Credit/Programs: Precollege credit/programs indicate coursework that may lead to college credit awarded upon successful course completion or an end-of-course exam taken by students before high school completion. Examples of precollege credit include DE, AP, and IB.

Socioeconomic Status (SES): SES referred to students who were at, above, or below the poverty line by 100% as defined by the U.S. Census. Often measured as a combination of education, income, and occupation, this study uses the parental income of the HSLS:09 participating students to define SES.

Organization of the Study

This study is organized into five chapters. Chapter One began with a discussion of the topic, research question, and significance of the study. Chapter Two summarizes relevant literature on the common characteristics of rural students, the communities where they live, and the influence of DE within their educational systems. Chapter Two further provides a historical overview of Vincent Tinto's (1997) SIM to present how and why this theory serves as the foundational basis for this study. Chapter Three describes the data source, quantitative methods, and key variables used in designing and conducting this study. Chapter Four details the results of the study. Finally, Chapter Five discusses the implications of the study and also provides recommendations for areas of future research and practice as well as the conclusion of this study.

CHAPTER TWO

LITERATURE REVIEW

There is extensive research on the benefits of DE for students who participate in DE courses and programs. These benefits include increased academic rigor, ease of transition between high school and college, cost savings from reduced or waived tuition, and decreased time to college degree attainment (Barnett & Kim, 2014; Kilgore & Wagner, 2017; Partridge, Schaller, Berry, & Routon, 2020). Further, prior research indicates that DE may have even greater benefits for low-income and underrepresented student populations. While DE opportunities are not the only college credit options for high school students, DE courses and programs are offered more widely in rural schools and school districts than in nonrural areas (U. S. Department of Education, Civil Rights Data Collection, 2015-16). Even though DE participation is increasing in rural areas, much of the literature on DE relates to college enrollment and persistence at the program or institutional level focusing mostly on urban and suburban student populations (e.g., Allen & Dadgar, 2012; Hughes, Rodriguez, Edwards, & Belfield, 2012). Limited research exists on the postsecondary educational persistence of students who participated in DE on a national level (An, 2013; Shapiro, Dundar, Huie, Wakhungu, Yuan, Nathan, & Hwang, 2017). Moreover, DE studies that examine college persistence based upon rurality are virtually nonexistent.

The purpose of this study is to explore the relationship between students who take DE courses in a rural high school classroom and their likelihood of persisting in college

from the first- to the third-year. First, this literature review summarizes Vincent Tinto's theoretical models on student integration which guide this research and provide a conceptual framework for addressing the research question and hypothesis of this study. Next, this section presents a review of the literature on rurality and the rural student, the influence of the rural family and friends, the role of rural schools to a student's decision whether to leave or stay in their home community and the influence of whether they decide to pursue a college degree. Then, this section describes a historical overview of DE, the advantages of DE over AP, criticisms of DE, as well as college accessibility and affordability. Further, this chapter discusses college persistence and the unique challenges for students who take DE courses in a rural environment, which include varying DE school policies and instructional practices. Finally, this review summarizes the gaps in the literature that this study proposes to fill as related to how DE and rurality may shape a student's postsecondary educational decisions, persistence, and degree attainment.

Theoretical Framework

Educational persistence and degree attainment are important issues to postsecondary education. Increasingly, undergraduates take more than four years to complete a baccalaureate degree if they even finish a degree at all. Nationally, student first to second-year retention rates average 83% at four-year public institutions and 85% at four-year private nonprofit institutions (Shapiro, Ryu, Huie, Liu, & Zheng, 2019). In contrast, rates for students to gain a bachelor's degree within six years average 61% at four-year public institutions and 67% at four-year private nonprofit institutions (McFarland et al., 2019). This lower six-year graduation rate as compared to the first to

second-year retention rate suggests that persistence toward degree attainment remains a significant problem.

Most of the foundational theories on college persistence evolved as a result of the work from Vincent Tinto's (1975) Student Integration Model (SIM). Tinto's (1975) SIM asserted that a student's decision to drop out of college is based upon the level of their social and academic integration within the institution. His model suggested that students enter college with certain background traits (e.g., race, academic achievement, family, and financial circumstances), which lead to initial commitments, both to the goal of degree completion and to the specific college attended. Tinto argued that it is these initial commitments that influence academic performance and social interactions and affect the student's level of integration within the institution. The greater the individual's integration within the college, the greater their commitment to the institution and the goal of degree completion. Later, Tinto expanded this SIM to include the importance of the college classroom in his theories on student college persistence. In his (1997) *Classroom as Communities,* which is also the foundational model for this study, Tinto asserted that the college classroom is the center of educational activity and crucial to a student's academic and social integration with an institution. He pointed out that for students who commute and have multiple obligations outside of college, the classroom may be the only place where students and faculty meet without any other distractions. Tinto suggested that the collaborative learning community within a classroom environment enables students to develop strong relationships with faculty and peers that may help to support and better integrate them into the social communities and academic life of the institution. Thus, the greater the student involvement within the classroom, the greater the academic and social

involvement within an institution and the stronger the student's commitment to college persistence and degree completion.

While Tinto's classroom theory emphasized the role of the college classroom, several researchers have focused on the role of the high school curriculum and classroom as being important predictors of student success in college (Adelman, 1999, 2006; Byun et al., 2015). Some of the most notable studies examined DE courses and found positive associations between DE and outcomes such as high school graduation, college enrollment, first-year college GPA, and first- to second-year college persistence (An, 2013; Hughes et al., 2012). Although DE was initially designed for high achieving students, there has been limited research that argues that the benefits of participating in DE courses appear to be greatest for middle- to lower-achieving students, low-income, and underrepresented student populations (Edwards & Hughes, 2011). Because DE courses may count for both high school and college credit at typically reduced or no cost to the student, the overall college costs for a student may be less and thereby eliminating some of the financial stresses of attaining higher education (Cassidy, Keating, & Young, 2010; Jones, 2014; Karp & Hughes, 2008). As a result, these benefits have led educational leaders and policymakers to support DE in their efforts to address college completion goals and provide students access to more of these courses. Regardless of the increasing popularity of DE, most of the research has been limited to states or individual college systems and programs. Additionally, research related to college persistence rarely studies long-term persistence to college completion. Most studies focus on college enrollment or first- to second-year persistence. However, researchers agree that the

attrition of second-year students warrants further analysis (Loes, An, Saichaie, & Pascarella, 2017; Nora, Barlow, & Crisp, 2005).

The Importance of Second- to Third-year College Persistence

Many colleges and universities emphasize retention efforts on students during their first year. However, most campuses lose as many students through attrition from the second year to graduation as are lost from the first to the beginning of the second year (e.g., Nora & Cabrera, 1996; Nora, Cabrera, Hagedorn, & Pascarella, 1996; Braxton, Milien, & Sullivan, 2000; Nora, 2004). Much of this early work relied on Tinto's (1975) SIM. Subsequent studies modified Tinto's original (1975) model and led to the use of models such as Bean and Metzner's (1985) student attrition model, Pascarella and Terenzini's (1980) interpretation of Tinto's (1975) theoretical framework, and even Astin's (1984) student involvement perspective. Limited literature examines student persistence rates from the second to third years and the factors that influence a student's decision to stay or leave college completely. Research that tests long-term persistence to degree completion is limited by both the difficulty in tracking students into and out of institutions and by the absence of comprehensive prediction models (Pascarella & Terenzini, 2005). The limited research developed using secondary data might be insufficient to establish preventative measures to combat student withdrawal. Some students may transfer to another degree program at the same institution; others may transfer to another institution; some may change their educational decisions (e.g., transfer from a two-year to a four-year or vice versa); and lastly, other students may withdraw postsecondary education altogether. Moreover, research is also limited by the inability to distinguish dropouts from transfer students, which are two very different outcomes as

students leave postsecondary institutions (Aulck, Velagapudi, Blumenstock, & West, 2016; Ishitani & Flood, 2018; Tinto, 1975, 1987).

Nevertheless, this study focuses on third-year enrollment status, rather than first-year retention, because of several reasons: (1) third-year enrollment status may be a more reliable predictor for degree attainment; (2) students who return for their second year may drop out or transfer by their third-year; and (3) even though this study was limited from comparing first- to second-year persistence, the influence of DE on long-term college persistence, especially for rural students, is not well documented. Therefore, this study used a modified version of Tinto's (1997) SIM to analyze the influence of DE on college persistence from the rural student perspective. I believe that the results from this work are an important step in understanding the complexities of college persistence for students who participate in DE courses and especially for students taking DE courses in rural communities.

Conceptual Model

It is for the above-mentioned reasons that I selected Tinto's 1997 *Classroom as Communities* SIM that links classrooms, student learning, and college persistence as the framework for my conceptual model to assess the passage of a student who took high school DE in a rural environment through their first- to third-year of college. Many researchers have recognized the importance of the classroom to student learning (Newhouse, 2021; Rands & Gansemer-Topf, 2017; Tinto, 1997). In Tinto's (1997) model, he asserts that even though a student begins college with a range of background traits (e.g., family background, academic skills, abilities, and prior schooling), it is the academic experiences as well as the faculty and peer interactions within the classroom

that promote student persistence. Tinto (1993) identified two of the most common external factors that shape persistence are obligations and finances. He defines obligations as "the responsibilities individuals have in regards to associations with groups or communities external to the college (e.g., families and work), whereas {finances} refers to the ability of the individual to finance college attendance" (p. 38). For the rural student, being able to isolate themselves from the influence of outside pressures (e.g., family responsibilities and environmental poverty) within the DE classroom may allow the student to focus more on the academic rigors of the advanced program. Moreover, a student who participates in a high school DE classroom is often offered the college-level course at a discount or even free, which can reduce the financial pressures of attending college (Barnett & Stamm, 2010; Cassidy et al., 2010; Jones, 2014). Although Tinto's model suggested that student characteristics such as determination and effort are equally important for student success, students who are under stress (e.g., work commitments, financial pressure, or family obligations) may not persist towards a degree. He argued that regardless of the external factors in a student's life, faculty and students can interact within this context without distractions (Tinto, 1997).

Prior literature identified other important predictors of students' educational outcomes. School-related factors such as academic curriculum combined with individual characteristics (e.g., gender, race/ethnicity, and SES), and influence from friends and family are important to college persistence (Agger, Meece, & Byun, 2018; Ma, Pender, & Welch, 2016). For instance, Astorne-Figari and Speer (2018) revealed that men were more likely to drop out of college while women were more likely to switch majors. Though they found no evidence that switching majors affected the academic performance

of women, dropping out of college affected men over a much longer term (e.g., economic earning potential). Nevertheless, other studies found that high school academic preparation was more important to college persistence than gender, race/ethnicity, SES, or rurality. For example, a qualitative article by Lancaster and Xu (2017) examined the experiences of African American STEM students at a four-year institution. They found that the barriers to degree completion for these students included: weak relationships with faculty; large and infrequent class offerings; and inadequate high school preparation for challenging classes. Conversely, a quantitative research study by Farruggia, Han, Watson, Moss, and Bottoms (2018) explored noncognitive factors such as academic mindset (e.g., sense of belonging, self-efficacy), academic perseverance (e.g., grit, delayed gratification), learning strategies (e.g., time management, self-regulated learning), social skills (e.g., interpersonal skills, empathy), and academic behaviors (e.g., going to class, doing homework) as related to academic success. They found that academic mindsets and perseverance were important to academic success but to a lesser degree than academic performance. Similarly, Westrick, Le, Robbins, Radunzel, and Schmidt (2015) found that first-year academic performance was a better predictor of second and third-year retention than SES. Even though Ma, Pender, and Welch (2016) found that college enrollment rates were higher for those from the highest SES quartile than for those from the lowest and middle SES quartiles, they concluded that SES was a weak predictor of both academic performance and college retention once a student entered college. When rurality was factored into research studies, however, challenges for students to persist until degree completion become more prominent. For example, a quantitative study using the National Educational Longitudinal study of 1988 (NELS:88) by Wells, Manly, Kommers, and

Kimball (2019) concluded that rural students had lower rates of enrollment and degree completion than their nonrural peers. When they controlled for factors such as SES, rates of college completion between rural and nonrural students reduced. Yet, they also found that there were relatively higher increases in academic preparation for rural students as compared with nonrural students. Still, they were other unobserved factors that could not be explained that maintained rural and nonrural disparities. Their results were consistent with an earlier study by Byun, Meece, and Irvin (2012) which indicated that race/ethnicity, family SES, the high school curriculum were significant factors for college completion among rural students. Though there are some similarities between rural students nonrural students with the same background, research indicates that students who attend schools located within rural communities have other issues that make their pathway to college more challenging than for students attending schools in urban or suburban schools.

While research does not directly link the DE classroom to student persistence, I propose to examine the relationship of high school DE on first- to third-year college persistence, controlling for gender, race/ethnicity, SES, and rurality to further explore college persistence particularly for rural students. To analyze this research, I have adapted Tinto's 1997 theoretical SIM framework as the basis for my conceptual model to examine the extent to which DE courses influence first- to third-year college persistence. The following section describes rurality and the rural student as well as the benefits and challenges of taking DE in a rural environment.

Definitions of Rurality

Historically, rural identity has been strongly associated with a place. People often relate to being "rural" because of who they are and not because of where they are located (Falk, 1996). In general, a rural area or countryside is a geographic area that is located outside of towns and cities, but community kinship and shared closeness to family and nature are the most common components of rural identity and symbolic of their thinking (Bell, 1992; Greider & Garkovich, 1994; Petrzelka, 2004). While there are no clear definitions of rurality, research indicates that where a student lives, particularly during childhood, is a key determinant of college participation (Chetty, Hendren, & Katz, 2016; Rothwell & Massey, 2015). A review of rural sociology literature operationalizes the definition of rural in the category of place-based theories, with the more common characteristics being population density and geographic size (Koziol, Arthur, Hawley, Bovaird, Bash, McCormick, & Welch, 2015). The most frequently used definitions come from four different sources: the U.S. Bureau of the Census, the Office of Management and Budget (OMB), the U.S. Department of Agriculture's Economic Research Service (ERS), and NCES. These agencies generally define rural by geographic location (i.e., rural, urban, and suburban), population, and economic outcomes. In terms of population, the agencies cite two types of urban localities — urban areas and urban clusters. Urban areas are locations with 50,000 or more people; urban clusters include at least 2,500 but fewer than 50,000 people. Rural areas, on the other hand, have 2,500 people or fewer and comprise all population, housing, and territory not included in an urban area or cluster (Ratcliffe, Burd, Holder, & Fields, 2016; U.S. Census Bureau, 2010; U.S. Department of

Agriculture, 2017; U.S. Office of Management and Budget, 2010).

In educational research, the NCES uses the rural, urban, and suburban terms as defined by the U.S. Census Bureau to classify schools and school districts. Therefore, this study uses NCES classification to identify and differentiate rural schools and school districts in relatively remote areas from those located just outside urban centers (Gerverdt, 2015). Additionally, prior comparative educational research studies have also used both *rural* and *nonrural* terms to differentiate student groups (e.g., Byun et al., 2017; Byun et al., 2012, 2015; Wells et al., 2019). Although there may be some similarities between rural and nonrural locations, this study will highlight several factors that are unique to the rural community. Thus, this study uses the term *rural* to define rural locations outside urban and suburban areas. *Nonrural* defines both urban and suburban locations unless differences between students attending urban and suburban schools are emphasized. The section below describes the interconnectedness of the rural family and friends, the role of the school, budgetary funding challenges, rural school advantages, and the influence of DE in rural schools.

The Influence of the Rural Family

Many rural students face a common challenge when considering their postsecondary educational choices. Whether to remain in their rural communities and stay close to their families and friends or to move away and pursue educational and career opportunities not supported in their areas (Meece, Hutchins, Byun, Farmer, Irvin, & Weiss, 2013). Research indicates that rural students' tight and interconnected relationships with family and friends are among the primary influencers on their postsecondary decisions to attend college, where to attend, and even whether they remain

in college (Byun et al., 2012; Demi et al., 2010). With limited economic opportunities available to students in rural areas, families and community members struggle with the possibility that youth might leave the areas and never return (Petrin et al., 2014). Scant research has investigated the extent to which family background explains rural and nonrural differences in college education. Among the limited studies, Byun, Irvin, and Meece (2012) used data from the National Education Longitudinal Study of 1988 (NELS:88) and concluded that SES posed the most significant challenges for rural student college enrollment and degree attainment as compared to nonrural students. The results indicated that rural parents had lower levels of educational expectations for their children and thus, lower levels of involvement in their children's education. In more recent research, Byun, Irvin, and Meece (2015) maintained that rural-nonrural differences in college enrollment and degree attainment were explained by differences in SES, but they also observed differences due to high school preparation. They concluded that SES, high school academic intensity as well as other demographic factors explained more of the differences in rural and nonrural college attendance and persistence patterns.

Partly due to industrial restructuring from agriculture, mining, and timber industries to manufacturing and service industries, rural populations often have lower median family-household and per-capita incomes, higher poverty rates for families and individuals, and higher unemployment rates compared to nonrural areas (Hamilton, Hamilton, Duncan, & Colocousis, 2008; Jacob, Bourke, & Luloff, 1997; U.S. Department of Agriculture, 2017). Of the nearly 7.5 million public school students who were enrolled in rural school districts during the 2016-17 school year, nearly one in six of those rural students' lives below the poverty line. Also, as many rural schools across the U.S. are

relatively small as compared to nonrural schools and school districts, they receive less state or federal funding as a result. The median enrollment for U.S. rural districts is 494 students, and at least half of rural districts in 23 states enroll less than the median (Showalter, Hartman, Johnson, & Klein, 2019). In turn, rural youth from low-income families have less positive educational outcomes as measured by academic achievement, high school graduation rates, college enrollment, and college completion (Koricich et al., 2018).

Although recent data indicates that more rural residents are earning high school diplomas or equivalent, rural areas are still lagging in the share of adults with college degrees as compared with adults in nonrural areas (Wells et al., 2019). Moreover, the rural students who are attending college are more likely to attend a two-year over four-year college and less selective four-year colleges than nonrural students (Koricich et al., 2018). Byun, Meece, and Agger (2017) used a national sample of 2,112 students from rural high schools to investigate patterns of college attendance as well as the role of family and school-related influences on college attendance. They found that 57% of the rural students enrolled in a two-year college, but only 24% of those enrolled transferred to a four-year college. Additionally, 32.1% of students enrolled in a four-year college, and 6.7% then transferred to a two-year college. Lastly, 3.5% of students had other attendance patterns (e.g., attended a two-year and then a four-year college, and then returned to a two-year college, etc.). The reasons that factored into rural students' college attendance decisions were mostly because of college proximity. In other words, two-year colleges were more often closer to their home communities than four-year colleges (Byun et al., 2017). These findings were similar to other prior studies on rural students' college

enrollment and attendance (Irvin, Byun, Smiley, & Hutchins, 2013). For instance, earlier research by Turley (2009) analyzed data from NELS:88 to examine the college enrollment patterns of 17,000 Grade 12 students. Turley revealed that the closer a student lived to a college, the more likely it was for that student to attend a postsecondary institution. However, Turley indicated that the effect of college proximity is small when compared to the effect of other factors such as race/ethnicity and parental education. Turley also found that lower parental incomes were associated with lower odds of applying to and enrolling in college, lower parental incomes were also associated with higher odds of enrolling in a nearby college. Thus, students with lower parental incomes were more likely to attend a college or university if it was located closer to their community.

When choosing a college to attend, many students enroll nearby. Approximately 57% of the incoming freshmen attending public four-year colleges enroll within 50 miles of their permanent home (Eagan, Stolzenberg, Ramirez, Aragon, Suchard, & Hurtado, 2014). A strong connection to place may make rural students seek educational pathways and careers that allow them to remain within their home communities. Yet, remaining in a rural area for postsecondary education can be problematic because many rural communities are "education deserts" with few or no college choices nearby. An education desert is defined as a local area where there are little to no colleges within the area. Education deserts do not occur at random and are systematically drawn along lines of race and class where low-income neighborhoods and communities of color tend to have the poorest access to educational opportunities. Between 1.29 and 2.86 million students attend college in education deserts and many of them are concentrated in rural areas of

low population density (Hillman, 2016). Students who live in education deserts are more likely to apply to and enroll in colleges farther away from home or a less selective college than students who have more college options available nearby (Klasik, Blagg, & Pekor, 2018). Considering the lack of postsecondary education opportunities available to many rural students, the prospect of whether to leave or remain in their community can have long-term consequences, including a lower likelihood of completing a degree (Ovink, Kalogrides, Nanney, & Delaney, 2018).

Choosing Whether to Leave or Stay in a Rural Community

Many rural areas in the United States have undergone significant social, economic, and demographic changes. While some rural communities have become high-amenity retirement or recreational destinations, other places have experienced a decline in agriculture and manufacturing businesses, which have led to population loss and closing of businesses that once served farming communities (Petrin et al., 2014). Although some young people would prefer to stay in their rural communities, unemployment and economic stagnation have caused many to leave. These events have created several challenges for rural communities, including reducing the outmigration of youth.

Youth outmigration is an issue within rural communities for many reasons. One of the more significant challenges for rural areas, however, is that population decline is associated with income inequality (Butler, Wildermuth, Thiede, & Brown, 2020). Although links between income inequality and population change vary by geographic region, population decline in rural regions are often characterized by lower per capita income, decreased tax bases, and declines in educational achievement (Cromartie, 2017;

Johnson & Litchter, 2019; Mattingly, 2020; Economic Research Service, 2017). The rural student is therefore left in a difficult situation. They must decide whether they will leave and pursue opportunities elsewhere or stay in the community with their families and social connections.

Those who leave rural areas are called "leavers" which is used to refer to those who choose to leave the locale in search of other opportunities, such as education, jobs, careers, or other reasons. Those who choose to remain in their rural communities are generally called "stayers." Many stayers may wish to remain in the area, while others might rather leave but cannot.

The Rural Student Leaver. The people who leave rural communities, also known as "leavers," are generally classified as high-achievers whom the local people (parents, teachers, guidance counselors, etc.) urge to leave so that they can find more opportunities (Carr & Kefalas, 2009). For these communities, it can be difficult to see the highest achieving students leave, but it may seem as if leaving is the only chance these students have for upward social mobility (Sherman & Sage, 2011). Teachers and counselors in these areas face the reality that advising these students may lead to young people leaving their communities and never returning. Nevertheless, they understand that those who choose to attend colleges near rural communities may have a limited range of academic programs that do not adequately serve their students and may lead to lower graduation rates (Hillman, 2016). Among the limited studies on rural students, a qualitative study by Farmer, Dadisman, Latendresse, Hill, Farmer, Thompson, and Irvin (2006) focused on understanding what adults, including parents, teachers, and community leaders, perceived as successful outcomes for rural African-American students in their

communities. Focus groups with these adults identified two major outcome perceptions: 1) The successful adult would leave to attain more education and establish a career that could not be supported within their community; and 2) The successful adult would stay and establish a career without leaving their community.

The general view of focus group participants was that because of highly limited economic resources, educational opportunities, and employment options in the rural community, it would be necessary for most youth to leave the community to establish successful careers and economic independence. Even though some parents acknowledged that they had limited opportunities in their communities, they wanted more opportunities for their child(ren). For those who left the community, however, the parents expected that the successful adults should remain connected to their rural home by either returning home after they developed a career or vocation that the community could sustain (e.g., teachers, healthcare professionals, building trades); or the successful adults would return on weekends or special occasions to serve as role models for other youth in the community.

Nonetheless, students who choose to leave their communities and pursue a postsecondary degree away from home often continue to be influenced by their rural environment regardless of the distance they may have moved. Students must then navigate how their college attachment and rural identity intersect, which may also affect their educational experiences. For example, some rural students have described receiving regular advice from family members, high school counselors, teachers, coaches, and peers about their academic or personal decisions (Means, 2018). In addition to family and community support, research also indicates that local businesses, civic organizations, and

faith-based organizations can play critical roles in supporting rural students in their pursuit of higher education (Alleman & Holly, 2013).

The Rural Student Stayer. While educational and career opportunities may encourage some students to leave their rural communities, others choose to stay. A strong connection to one's home community may make some rural students desire to remain a part of that community even when engaging in postsecondary education (Petrin et al., 2014). The place attachment of these students, known as "stayers," may also increase their desire to attend college close to home, which has often been among the most important factors that U.S. high school students consider when choosing a college, especially rural students with low-SES (Turley, 2009). Yet, many rural areas are not near higher educational institutions, thereby increasing the financial costs for the rural student. Considering evidence that several rural areas may be characterized as "education deserts" with no more than one community college within a reasonable commuting distance, the desire to attend college close to home may diminish overall enrollment rates for rural students who may be forced to move away for additional educational opportunities (Hillman, 2016). The lower access to college and a college educated population can affect economic opportunities as well. Historically, many rural areas have been able to offer employment in sectors such as manufacturing or agriculture that did not necessarily require a postsecondary degree. However, businesses are increasingly seeking highly skilled and educated workers to fill jobs. To help students gain these much-needed jobs, some rural schools, in collaboration with community groups, have begun to focus on increasing DE offerings of targeted programs, such as those within STEM areas, to stimulate economic growth and opportunities.

Nationally, growth in STEM-related careers has been three times faster than non-STEM careers (Langdon, McKittrick, Beede, Khan, & Doms, 2011). In the next decade, almost all of the 30 fastest-growing careers will require some STEM-related skills. Yet, fewer than 40% of students who enter college intending to major in STEM persist to graduate with a STEM degree (American College Testing, 2011). As a result, rural school districts seek ways to help their students obtain jobs in these rising fields regardless of whether the student is a leaver or stayer. Many believe that the promise of STEM can support rural students' explorations of foundational math and science courses as well as engage them in addressing research issues within their communities. For instance, researchers studying students' reasons for pursuing postsecondary education leading to STEM careers found that students' interests were related to their level of math achievement in grade 12, exposure to math and science courses, and math self-efficacy beliefs (Miller & Benbow, 2012). These findings suggest that investment in DE STEM programs may have promise to support rural students with their higher education goals and careers.

The Role of Schools in the Rural Community

Nationally, nearly 7.5 million public school students were enrolled in rural school districts during the 2016-17 school year, almost one of every seven students across the country (Showalter et al., 2019). Yet, rural schools and rural education are typically overlooked as related to education policies and academic scholarships. The factors that have contributed to the invisibility of rural schools, districts, students, and their families include geographic isolation, loss of industry and economic bases, poverty, lower school district budget revenue, and lack of political capital (Johnson et al., 2016). Though

federal and state funding formulas are meant to close educational achievement gaps, funding formulas treat rural, urban, and suburban schools the same (Johnson et al., 2016). School enrollment drives public school funding. Because many rural school districts across the U.S. are small as compared to nonrural schools and school districts, they receive far less funding. The results of this lower funding are educational inequalities for rural K-12 students as compared to their urban and suburban peers (Showalter et al., 2019; Byun et al., 2012, 2015; Koricich et al., 2018; Kotok, Kryst, & Hagedorn, 2016). To reverse this trend, educational leaders have increasingly touted DE as an effective tool, particularly for underrepresented and low-income students (Gagnon, Liu, & Cherasaro, 2021; Nelson & Waltz, 2019). The rationale is a belief that DE increases equity by giving participants exposure to college-level courses at lower costs than taking the same courses in a traditional college will thereby reduce the financial burden of attending a postsecondary institution (Miller et al., 2017).

Overview of Dual Enrollment (DE)

High school DE, also known as "dual credit" and "concurrent enrollment" (among other terms), refers to high school students enrolled in a course (s) that allows them to receive credits that apply both to high school diploma requirements and college graduation requisites. Although students taking DE courses may not necessarily receive high school credit, they typically receive college credit for passing these courses. Other commonly used terms of dual credit and concurrent enrollment generally refer to programs in which students earn high school and college credit simultaneously. Therefore, each of these terms will be referred to under the umbrella of DE.

While the first DE programs emerged in the 1950s, their popularity has soared over the last decade (Thompson, 2017). Between the 2002-03 and 2010-11 academic years, the number of high school students taking college courses for credit increased by 68%, to nearly 1.4 million (NCES). Currently, all states offer some form of DE, and about a third of students take classes for college credit during high school (Education Commission of the States, 2016; McFarland et al., 2019). With this trend, more rural schools and school districts have also been increasing their DE offerings over AP or IB than even urban and suburban areas (Rural, 10.8%; Urban, 6.4%; Suburban, 7.3%) (U.S. Department of Education, Civil Rights Data Collection, 2015-16). Empirical research indicates that students who participate in DE courses have higher grade point averages (GPAs), are more likely to complete a college degree, and accumulate less debt than non-participants (e.g., Freismuth, 2017; Hunter et al., 2019; Grubb, Scott, & Good, 2017; Warren & Goins, 2019). For colleges and universities, DE programs provide opportunities for increasing enrollment and tuition revenues. Additionally, community colleges and smaller schools have a chance to reach high-achieving students who may not have considered such schools (Hughes, 2010).

DE Student Characteristics

Though DE was originally intended for gifted and advanced students, it has since expanded to include a wider range of students. Participating in DE courses has been found to improve educational outcomes for students, in particular low-income and minority students (An, 2013). However, there are still many barriers to both participation and success. Because states and school districts vary widely in terms of who participates in DE courses, some states have crafted policies that encourage historically

underrepresented students to take DE (Education Commission of the States, 2016). Despite the best intentions of state policies aiming to increase equity and access, research generally finds that DE courses are still racial and economically stratified, an issue that remains consistent in rural communities as well (Miller et al., 2017; Museus, Lutovsky, & Colbeck, 2007). Rising immigration and changing racial and ethnic composition, especially among Hispanics, in rural America has gone largely unnoticed as most media attention focuses on the rise of majority-minority urban and suburban areas (Morello & Keating, 2011). The nonmetropolitan population of racial and ethnic minorities increased from 8.6 to 10.3 million between 2000 and 2010 while Whites hardly grew at all (U.S. Census Bureau, 2000, 2010). Yet, the students who typically participate in DE courses are more likely to be white males from high-SES backgrounds (U.S. Department of Education, Civil Rights Data Collection, 2015-15; Museus et al., 2007; Pierson et al., 2017). Moreover, students who attend high schools serving high populations of minority students are significantly less likely to have access to DE courses (U. S. Department of Education, Civil Rights Data Collection, 2015-16). For instance, a recent study by Rivera, Kotok, and Ashby (2019) used HSLS:09 data to analyze the probability of a student to enroll in DE courses during high school. They found that SES and prior achievement were strong predictors of whether students participate in DE with over 63% of DE students who tended to be White and have middle- to high-SES. Additionally, they found that racial minorities were significantly less likely to participate in DE, while being female and higher SES was positively associated with DE enrollment (Rivera, et al., 2019). These enrollment disparities can affect college preparedness and potentially lead to lower college persistence and graduation rates (Evenbeck & Johnson, 2012).

Higher-SES students enroll in DE more often due to several advantages including higher-average achievement, family social capital, and the ability to pay extra fees in states where DE requires some form of payment (Miller et al., 2017). Yet, research among the student groups which benefit the most from DE participation are low-income students even though they are less likely to enroll in college or obtain a degree than students when compared to their White, more affluent DE peers (An & Taylor, 2019; Berger et al., 2013; Miller et al., 2017). Another reason why DE may be especially important for low-income rural students is that, oftentimes, low-income students can earn DE college credits that are free or heavily subsidized, which can reduce the financial burden of pursuing a college degree (An, 2013). Despite the benefits DE could provide racial/ethnic minorities and low-SES students, few studies have examined the differences in college persistence and degree completion for these student populations as compared to the majority of participating DE students (An, 2013; Pretlow & Wathington, 2014).

In addition to lower rates of minority and low-SES student participation in DE, there are also discrepancies according to gender. In general, females participate in advanced coursework and attend college at greater rates than males. (Handwerk, Tognatta, Coley, & Gitomer, 2008; Kena et al., 2016). A recent study by Agger, Meece, and Byun (2018) pointed to higher academic achievement and postsecondary enrollment at greater rates for rural females as compared to males. Yet, DE participation seems to be contrary to the trend of postsecondary advancement with males being far more likely than females to participate in DE (U.S. Department of Education, Civil Rights Data Collection, 2015-16). Even without gender differences in DE offerings, the RAND Corp produced a study published in 2017 that surveyed dual enrollment programs in Texas, as

the state expanded access to DE over the past two decades. This report found that as the number of DE students increased, the racial and economic gaps in participation increased, advantaging the white and wealthy (Miller et al., 2017). Although research supports that DE helps students prepare for, succeed in, and graduate from college, studies reveal that DE opportunities are not equally shared by non-white, non-wealthy students of color.

As there are gender, race/ethnicity, and SES differences in DE participants, there are also geographic differences in DE courses as well. According to the 2015-16 U.S. Department of Education Civil Rights Data Collection, more rural schools and school districts offered DE instead of AP than even urban and suburban areas (DE participation by school locales are 10.8% for rural, 7.3% for suburban, and 6.4% for urban). While DE courses may be offered in a wide variety of settings (e.g., in a high school, at a two- or four-year college, or online), rural schools are more likely to offer DE programs through distance education as compared to students from towns, urban, and suburban areas (38%, 28%, 15%, and 13% respectively). Moreover, rural students participating in DE courses were more likely to be taught by high school instructors than postsecondary instructors (Ralph, 2013).

DE Criticisms

Though DE proponents tout the benefits of the program, there are critics of the program as well. With increasing DE programs targeting low-income who struggle academically or those who are from historically underrepresented populations, some question whether DE courses, often taught in high schools or online as is the case for many rural students, and by high school instructors, are comparable to college classes (Evenbeck et al., 2012; Jones, 2014; Tinberg & Nadeau, 2013). Because DE courses are

actual college courses, as opposed to college-level courses or curriculum such as AP and IB programs, instructors are expected to maintain the same standards, texts, and evaluation assessments as the sponsoring college or university. A study by Ferguson, Baker, and Burnett (2015) indicated that DE courses were at least as rigorous, if not more rigorous, than those taught to students on a traditional college campus. Further, the faculty that they interviewed tended to assess the academic ability of DE students as generally higher than non-DE students. Yet the most common concerns regarding students who participated in DE courses or programs are a lack of academic preparation for college coursework and issues regarding effective adjustment to the college environment (Hughes et al., 2012).

Doubts about the rigor of dual credit courses have led some colleges to limit the number of courses that will transfer or to accept only those that were taught on college campuses, by college faculty. For some participating DE students, there may be a gap between their academic skills and their readiness to engage in college-level coursework. These gaps may make it challenging for these students to grasp the material being taught, and potentially hurt their ability to be successful in a DE course. The long-term damage for an unsuccessful DE student is that they may receive poor grades on their high school and their college transcript before they have the chance to begin their college journey (Karp et al., 2008; Jones, 2014). The National Alliance for Concurrent Enrollment Partnerships (NACEP), an accrediting body for concurrent partnerships, works to ensure that college courses offered by high school teachers are as rigorous as courses offered on the sponsoring college campus. However, NACEP accreditation is not required for schools to participate in DE partnerships, and standards for instructor qualifications may

not align with those for traditional postsecondary courses (Zinth, 2015). As a result, there is no assurance that students who participate in DE will be academically prepared for college coursework.

Although schools and school districts struggle with aligning high school and college credit for DE courses, these programs may also pose administrative challenges for postsecondary institutions as well. A key issue for colleges is finding appropriate classroom space when DE classes are held on college campuses. With continually rising tuition costs, decreasing governmental aid (An, 2013), and increasing volume of students attending college, neither parents nor state legislatures want to continue paying the escalating costs of higher education. Thus, supporting more and more students to pursue DE credits before college becomes an attractive option. As a result, a number of states are mandating that public colleges and universities accept an equal number of AP and DE credits (Guzy, 2016). Currently, over 25 states require public two- and four-year institutions to accept college credits earned through DE programs in their state (Durosko, 2019). Reports of first year students entering college with 30-60 credit hours are becoming more frequent. There are few studies that analyze the outcomes of students who take one or more DE courses. A study by Allen, Drew, Dadger & Mina (2012) found that completing one or more DE courses was associated with positive and substantial gains including earning more credits during the first semester of college and a higher college GPA. With more DE students taking core curriculum subjects such as English, Math, Political Science, and History, college administrators are concerned that DE classes negatively impact their revenues because participating students paid only nominal fees (Kinnick, 2012). Additionally, DE sponsoring colleges and universities are required to

hire staff that will administer and monitor the programs, but they do not always receive federal or state funding to cover the added personnel (Partridge et al., 2020). Proving the value of DE programs to the institution has become increasingly important as state budgets for higher education shrinks. National reports indicate rural high schools face similar challenges to implementing high-quality DE courses which include accessibility, financial costs (e.g., tuition, fees, textbooks, and transportation), lack of qualified teachers, and inconsistent state policies as related to DE.

DE Accessibility

As rural students were significantly more likely to take DE courses through distance education than students from towns, urban, and suburban areas (38%, 28%, 15%, and 13%, respectively), education leaders have expressed concern that rural students and students from low-income households lack access to affordable high-speed broadband (Ralph, 2013). Though online technology may have allowed rural students to enroll in DE courses, the lack of broadband connection can affect student performance with higher-SES and nonrural students having access to more rigorous courses. The COVID-19 pandemic has only further highlighted the digital divide. During the pandemic, many educational resources moved online, including textbooks and reference materials. For those without adequate internet connection, completing assignments can be very challenging if not impossible, a common issue for rural students (Rosenboom & Blagg, 2018; U. S. Department of Agriculture, 2018). The comparatively lower population density of rural areas may be the reason why broadband access is not as widely available than in more highly populated urban and suburban areas. The greater the geographical distance to customers, the higher the cost to serve those customers. While

there are many examples of rural communities with state-of-the-art technology facilities, studies have indicated that rural areas tend to lag behind urban and suburban areas with either higher speeds or by having no access at all (Rachfal & Gilroy, 2019).

Funding Challenges

Rural schools also face unique and complex funding challenges as well. Although a higher percentage of rural public schools offered DE than nonrural areas, these programs were more likely to rely on funding from students and their families (Taie & Goldring, 2017). As these regions tend to have smaller populations and student enrollment, their levels of federal and state funding may not cover DE tuition, textbooks, and fees associated with the program. Lower property values, combined with a relatively high tax burden and a lack of corporate tax revenue, resulting in a smaller economic base for educational spending (Zinth, 2016). The smaller the pool of funding a school or school district receives, the lower the schools' federal Title I money. Title I (more specifically Part A (Title I) of the Elementary and Secondary Education Act, as amended by Every Student Succeeds Act [ESEA]) provides financial assistance to local educational agencies (LEAs) and schools with high numbers or high percentages of children from low-income families to help ensure that all children meet challenging state academic standards. These federal funds are allocated through statutory formulas based primarily on census poverty estimates and the cost of education in each state (U.S. Department of Education, 2015). It is particularly difficult for small, rural high schools to meet the complex academic and social needs of all their students without the requisite number of highly trained teachers and the funds to expand advanced coursework and provide state-of-the-art equipment. Among rural schools that offered DE, a lower

percentage reported that the DE was funded by the school, district, or state than did schools located in other types of communities (72% as compared with 77% to 84%), and a higher percentage reported that it was funded by the family or the student than did schools located in towns or cities (50% as compared with 42% and 26%, respectively) (McFarland et al., 2019). Strategies to reduce cost include fully funding the state dual enrollment program so that it is free for all students, creating scholarship or grant programs to support students from low-income households, limiting what colleges may charge for dual enrollment courses, and covering the tuition and fees for a limited number of courses (Zinth, 2016).

Lack of Qualified Teachers

A lack of qualified teachers is also an issue for rural schools wanting to offer DE courses to their students. While some urban and suburban high schools offer DE courses led by college faculty who travel to the high school campus, longer travel distances in rural areas can make this option unrealistic (Zinth, 2016). To alleviate this issue, colleges may certify high school teachers to teach the DE course content. Many states require high school instructors to meet the same qualifications as postsecondary faculty at the partnering institution (e.g., have a completed master's degree and a minimum of 18 credit hours master's-level content in the subject of the course). However, rural districts may have difficulty recruiting and retaining teachers with these qualifications. Additionally, policies vary for certifying teachers across states. For example, Georgia mandated that all DE instruction should come from a postsecondary institution. Wyoming, on the other hand, allows any secondary teacher to teach a dual-credit course. The other 11 states fall between these two policy extremes (Zinth, 2015). As a result, rural schools are less likely

to offer a broad selection of DE courses to students, if they can provide any at all. This means that rural students may be less likely to take benchmark college readiness courses (e.g., college algebra, geometry, calculus) or a science course beyond biology (e.g., physics or chemistry) (Allen, Radunzel, Moore, 2017). For postsecondary institutions, issues arise when deciding whether to accept DE courses for college credit due to questions about the quality and rigor of DE courses (Tobolowsky et al., 2016).

Inconsistent State Policies

Currently, all states offer some form of DE (Education Commission of the States, 2016) and about a third of students take classes for college credit during high school (McFarland et al., 2019). According to the Education Commission of the States (ECS), 47 states plus the District of Columbia have statewide policies in place for DE, but these policies vary. As of 2016, 12 states mandated postsecondary institutions and high schools to participate in DE programs whereas 20 states suggested voluntary participation. Five state policies combine both voluntary and mandatory conditions, nine state policies do not specify policies, and four states have no statewide policy at all related to DE. Other states leave DE policies to the discretion of localities and their pertinent postsecondary institutions or systems (Education Commission of the States, 2016)

In summary, the above section describes some of the studies that suggest the benefits of DE to rural students yet the challenges of administering the program. Research suggests that the impact of DE on rural student college enrollment, persistence, and degree completion, particularly for low-income students, may be promising. However, the issues of financial costs, low school district funding, inability to secure qualified teachers, and inconsistent state policies may prevent many rural school districts

from offering DE courses to students. The next section describes the methods used to explore the effects of rurality on DE and college persistence. This research is important to assessing DE courses and programs for the students who may benefit from them the most.

CHAPTER THREE

METHODS

This chapter describes the methods used to determine the influence of DE on college persistence among rural students controlling for gender, race/ethnicity, SES, and rurality. For this study, a correlational design was employed to measure the degree of association between students taking DE courses before high school completion and persistence to the third-year of college. Students were defined as those who enrolled in four-year postsecondary institutions for the first time immediately following high school graduation. Persistence was defined by students who began at any four-year postsecondary institution in fall 2013 and remained enrolled through the third-year as of February 2016. Rurality was included as a moderating variable that alters the direction or strength of the relation between the DE predictor and college persistence as an outcome.

This study used secondary longitudinal data from the NCES HSLS:09 study. Random assignment of groups was not possible in this study due to time and expense; therefore, individuals were assigned to or self-selected into a treatment or ex post facto research design based on their preexisting characteristics with groups in the dataset (Guo & Frasier, 2014). To reduce selection bias, I controlled for extraneous variables by examining background characteristics (i.e., gender, race/ethnicity, SES, and rurality) as suggested by prior literature (Browman, Destin, Carswell, & Svoboda, 2017; Huang, Roche, Kennedy, & Borcato, 2017; Weeden, Gelbgiser, & Morgan, 2020).

This chapter discusses the conceptual model for this study as adapted from Vincent Tinto's SIM framework and is discussed in-depth. This chapter also defines the research question, HSLS:09 data sample, target population, sample design, conceptual model, treatment variables, and methodology.

Research Question

The research question guiding this study design is as follows:

To what extent does dual enrollment influence first- to third-year college persistence, controlling for gender, race/ethnicity, socioeconomic status, and rurality?

HSLS:09 Data Sample

Several reasons support the choice to use HSLS:09 as the appropriate data source for this study. First, HSLS:09 data included extensive information on student demographic and background characteristics for over 25,000 students in more than 900 public and private schools across the nation beginning in Grade 9 and following them through their first three years of college. Additionally, HSLS:09 includes school-level data on the geographic regions of the country including rural locations. Second, the first follow-up, conducted in 2012 when participating students were in Grade 11, provided transcript data on students' DE general, math, and science courses. Third, the 2013-14 update and high school transcript data, collected when students were in Grade 12, included academic precollege preparation across the first three years of high school (i.e., DE coursework) and high school completion status (e.g., transcript of courses, location of last high school attended). Further, the second follow-up (2016) and postsecondary transcripts (2017), conducted after the students' first three years of college, provided data on college enrollment after high school (e.g., dates of college enrollment and

persistence). More specifically, these data revealed whether students persisted from the first to the third-year of college. This study does not follow students through college completion because this information will be covered in the final 2025 follow-up. Even though other NCES longitudinal studies follow student persistence through college completion, the HSLS:09 was the only source that charted the progress of students who participated in DE courses from high school through college. Thus, HSLS:09 was the most appropriate source to explore the association of first- to third-year college persistence for rural students who took DE courses in high school.

To investigate the influence of DE on rural student college persistence, I focused on the 2016 second follow-up and 2017 postsecondary transcript collection that included data from five HSLS:09 data groups (i.e., Base Year fall 2009, spring 2012, fall/spring 2013-14, spring 2016, and spring 2017). Because I used publicly accessible data, I had to use prior years in some instances because data were suppressed in subsequent years. Throughout this dissertation, I refer to the 2009 Base Year survey as the *Grade 9 Survey,* the 2012 First Follow-up as the *Grade 11 Survey*, the 2013 Update and High School Transcript (U/HST) data collection as the *Grade 12 Survey,* the 2016 Second Follow-up (three years after high school completion) as the *College Survey,* and the 2017 Postsecondary Evaluation Transcript Study (four years after high school completion) as *PST*. These terms are important to help the reader understand the meaning of the timeline and do not necessarily describe students' class statuses at the time of a particular data collection wave. Table 1 outlines the HSLS:09 timeline and the sources for the variables of interest in this study.

Table 1

DE Research Sources from HSLS:09 Data Collection Timeline

Survey Year	Data Collected
Grade 9: Fall 2009	Gender, race/ethnicity, and SES
Grade 11: Spring 2012	DE courses including general, math, and science
Grade 12: Fall 2013	High school type (rurality)
College Survey: Spring 2016	College persistence at any institution (enrolled in third-year) (e.g., public, private, private non-profit, 4-year, 2-year, or less)
PST: Spring 2017	High school DE courses enrolled as listed on the college transcript

NOTE: DE = Dual Enrollment. These data reflect information obtained from the HSLS:09 base year, first follow-up, update and high school transcripts, second follow-up, and postsecondary transcripts evaluation (PST) public-use data files.

HSLS:09 Weighting

HSLS:09 data used a stratified, two-stage random design for selecting the sample and applied weights to the data with primary sampling units (PSUs) defined as schools randomly selected at the first stage and students randomly selected from schools at the second stage. During the first stage of the sampling process, stratified random sampling and school recruitment resulted in the identification of 1,889 eligible schools. From the sampling, a total of 944 of these schools participated in the study, resulting in a 55.5% (weighted) or 50% unweighted response rate. In the second stage of sampling, students were randomly sampled from schools' Grade 9 enrollment lists, with 25,206 eligible selections (approximately 27 students per school). More than 21,000 students participated, or about 86% (weighted) of eligible selected fall ninth-graders. HSLS:09 data used weighting to measure the magnitude of an effect and to make estimates from

the sample data representative of the target population (Miratrix, Sekhon, Theordoridis, & Campos, 2018). Because of this weighting design, NCES recommended the PowerStats statistical tool for researchers to generate descriptive analyses and linear regressions (NCES). However, PowerStats could not generate advanced computations such as the binary logistic regression analyses used for this study. Instead, I downloaded the HSLS:09 public-use data to SPSS software version 27 with a complex sample add-on for analyses. The complex sample add-on was included to handle the sample weights.

Target Population

The target population for this research included rural and nonrural (urban, town, and suburban) schools that participated in high school DE courses during the HSLS:09 data collection timespan. Target schools were defined as public schools, public charter schools, or private schools with students in Grades 9 and 11 residing in one of the 50 states or the District of Columbia. The HSLS:09 sample schools were obtained from two NCES files including the following: 1) The primary sample of regular public and charter schools was collected from the 2005-06 Common Core of Data (CCD); and 2) Private schools were sampled from the 2005-06 Private School Universe Survey (PSS). Schools that began in Grade 10 instead of Grade 9 were excluded from the sample to gain a better understanding of educational experiences starting in the first year of high school. The schools were then stratified by type (public, private, Catholic, and other private), region (Northeast, Midwest, South, and West), and locale (urban, suburban, town, and rural).

From the HSLS:09 full sample size of over 25,000 high school students, the study sample included: 1) Students who began Grade 9 in fall 2009 and were first-time enrolled in a four-year postsecondary education by fall 2013. 2) The sample was then restricted to

students who took at least one or more DE classes (general, math, and science) during high school. I included students who attended public, private, Catholic, and other private schools in the sample to observe any variability resulting from the type of high school where students take DE courses. 3) Because I used the most recent HSLS:09 public-use data, which was the second follow-up, I defined the sample of students as those who were enrolled in the third-year of college during the spring of 2016. 4) Lastly, I measured rurality by examining the location of the last high school the student attended before beginning college.

Sample Design

This study was conducted using longitudinal secondary data from the NCES HSLS:09. I selected a correlational design for this research to evaluate whether there was a relationship between the quantitative variables associated with DE and college persistence as measured by students persisting from the first to the third-year in college. Likewise, I chose binary logistic regression to measure the relationship between the independent variable of DE participation and the dependent variable of college persistence, controlling for gender, race/ethnicity, SES, and rurality. Moreover, logistic regression models have been used in previous studies as related to DE and college persistence as well (e.g., Byun et al., 2015; Pierson et al., 2017).

Conceptual Model Design

The conceptual model for this study is based on a modified version of Tinto's 1997 *Classroom as Communities* SIM. Though Tinto considered students' experiences (demographic background, academic preparation, and SES) to be important to college persistence, his model did not factor a students' precollege academic experiences in

courses such as DE as being a factor, which can lead to successful college integration. Therefore, I adjusted Tinto's SIM to include DE and demographic factors (i.e., gender, race/ethnicity, SES, and rurality) to understand the influence of such experiences upon college persistence, particularly for rural students. Figure 1 shows the conceptual model that provides the context for this research. This model traces the independent variables (including background characteristics (gender, race/ethnicity, SES, and rurality), precollege preparation (participation in at least one DE general, math, or science course), college type (four-year, two-year, or no college), and college experiences (location, sector, level, and selectivity of the postsecondary institution) that factor into a rural students' education-related choices and persistence. Though this model encompasses several college factors that Tinto suggests relate to college persistence, this study only focuses on sociodemographic characteristics and DE as precollege factors to examine their relationship on first- to third-year college persistence.

Figure 1

High School through College Conceptual Map

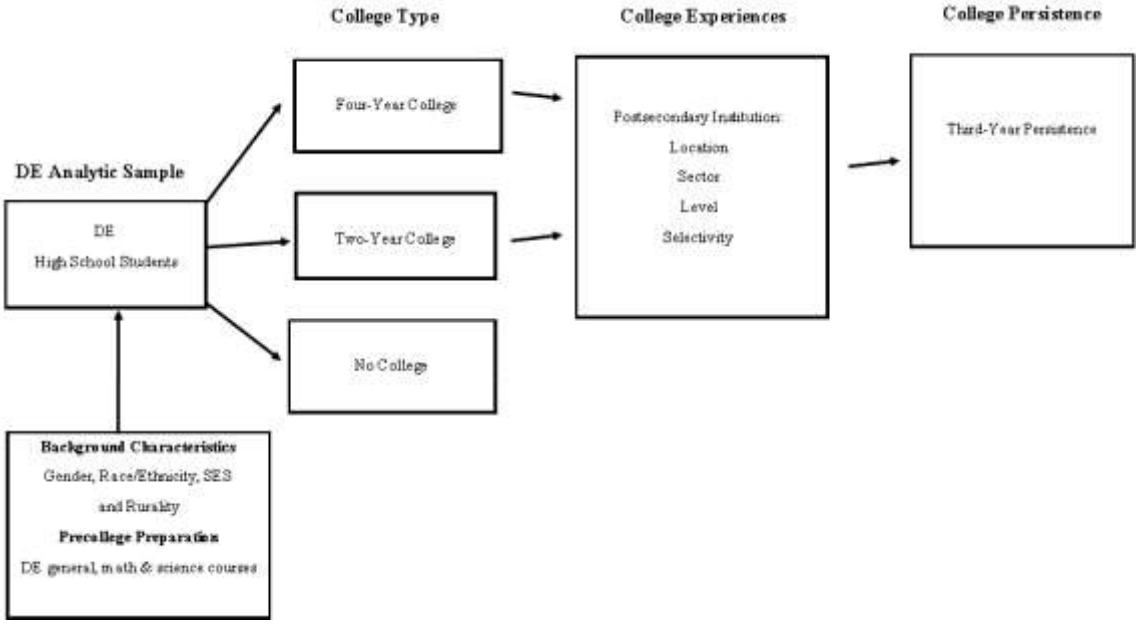

Figure 1. The high school through college conceptual map modified from Tinto's 1997 Student Integration Model served as the starting point for identifying key variables to be measured.

Variables of Interest

Despite tremendous growth in DE participation, literature on student college persistence after participating in high school DE courses is limited. Moreover, research on students who took DE in a rural environment is almost nonexistent. This study seeks to add to DE research by exploring the association of DE on college persistence for rural students. Consequently, I drew upon DE and rural student literature to select key variables of interest as described below.

Independent variable. The independent variable, DE, was defined as one or more DE classes in which both high school and college credit were earned before high school graduation as reflected on students' transcripts (Adams, 2013). To control for

external influences of DE course participation upon postsecondary persistence, I controlled for gender (in this case, a binary indicator of the student's sex: male, female), race/ethnicity (i.e., American Indian/Alaska Native; Asian, non-Hispanic; Black/African-American, non-Hispanic; Hispanic, no race specified; Hispanic, race specified; More than one race, non-Hispanic, Native Hawaiian/Pacific Islander, non-Hispanic; and White, non-Hispanic), SES (i.e., at or above poverty or below poverty), and rurality (i.e., city, suburban, town, or rural). In this study, SES was measured according to the participating student's family members who indicated that they were at, above, or below the 2008 poverty threshold by 100% as identified by U.S. Census (HSLS:09). Rurality was defined by the location of the last high school where the student was enrolled before beginning college.

Dependent variable. The dependent variable, college persistence, was defined as students who completed their first year at any four-year postsecondary institution and returned for the third-year. (Cataldi, Bennett, & Chen, 2018). Though most prior studies define college persistence as continued enrollment from the first to the second year, this study defines college persistence as continued enrollment from the first- to third-year because third-year enrollment status may be a more reliable predictor for degree attainment than the first to second-year and more study is warranted. Those students who do not return to a specific university or continue for another year for any reason and withdrew are defined as did not persist.

Moderating variable. Rurality was included as a moderating variable in this study. According to Frazier, Tix, and Barron (2004), **"**a moderator effect is nothing more than an interaction whereby the effect of one variable depends on the level of another."

(p. 116). The term rurality (rural) was defined as a student's last high school attended outside urban and suburban (nonrural) areas as categorized by the U.S. Census (U.S. Census, 2010). Rurality is central to this study as it addresses whether location alters the relationship between the independent variable (DE) and the dependent variable (college persistence). Within this correlational analysis, the rurality moderator was examined as the third variable that affects the correlation between the independent and dependent variables, or the value of the slope and provided an understanding of the influence of rurality between the independent variable, DE, and the dependent variable, college persistence (Wu & Zumbo, 2008).

Procedures

Having selected the independent variables and dependent variables to address the research question, the hypotheses comparison groups were then identified. Based on the dependent variable of first- to third-year college persistence, the referent group was identified as Group 0. The first independent variable, DE, was identified as Group 1. The second independent variable, Gender, was identified as Group 2. The third independent variable, Race/Ethnicity, was identified as Group 3. The fourth independent variable, SES, was identified as Group 4. The fifth independent variable, Rurality, was identified as Group 5. Thus, hypotheses are as follows:

Group 0 versus Group 1 (DE Participation):

H_0: The odds ratio of persisting in college from the first- to third-year by DE participation is the same across groups, and association with DE does not affect the outcome. This means that there are no statistically significant differences between a student who participates in at least one DE course to persist in college from the first- to

the third-year as compared to a student who does not participate in DE.

H_1: The odds ratio of persisting in college from the first- to third-year by DE participation is different across groups, and association with DE affects the outcome. This means that there are statistically significant differences between a student who participates in at least one DE course to persist in college from the first- to the third-year as compared to a student who does not participate in DE.

Group 0 versus Group 2 (Gender):

H_0: The odds ratio of persisting in college from the first- to third-year by DE participation in at least one DE course based upon gender is the same across groups, and association with DE based upon gender does not affect the outcome. This means that there are no statistically significant differences based upon gender between a student who participates in at least one DE course to persist in college from the first- to the third-year.

H_1: The odds ratio of persisting in college from the first- to third-year by DE participation in at least one DE course based upon gender is different across groups, and association with DE based upon gender affects the outcome. This means that there are statistically significant differences based upon gender between a student who participates in at least one DE course to persist in college from the first- to the third-year.

Group 0 versus Group 3 (Race/Ethnicity):

H_0: The odds ratio of persisting in college from the first- to third-year by DE participation in at least one DE course based upon race/ethnicity is the same across groups, and association with DE based upon race/ethnicity does not affect the outcome. This means that there are no statistically significant differences based upon race/ethnicity between a student who participates in at least one DE course to persist in college from the

first- to the third-year.

H_1: The odds ratio of persisting in college from the first- to third-year by DE participation in at least one DE course based upon race/ethnicity is different across groups, and association with DE based upon race/ethnicity affects the outcome. This means that there are statistically significant differences based upon race/ethnicity between a student who participates in at least one DE course to persist in college from the first- to the third-year.

Group 0 versus Group 4 (SES):

H_0: The odds ratio of persisting in college from the first- to third-year by DE participation in at least one DE course based upon SES is the same across groups, and association with DE based upon SES does not affect the outcome. This means that there are no statistically significant differences based upon SES between a student who participates in at least one DE course to persist in college from the first- to the third-year.

H_1: The odds ratio of persisting in college from the first- to third-year by DE participation in at least one DE course based upon SES is different across groups, and association with DE based upon SES affects the outcome. This means that there are statistically significant differences based upon SES between a student who participates in at least one DE course to persist in college from the first- to the third-year.

Group 0 versus Group 5 (Rurality):

H_0: The odds ratio of persisting in college from the first- to third-year by DE participation in at least one DE course based upon rurality is the same across groups (i.e., city, suburban, town, and rural), and association with DE based upon rurality does not affect the outcome. This means that there are no statistically significant differences based

upon rurality between a student who participates in at least one DE course to persist in college from the first- to the third-year.

H_1: The odds ratio of persisting in college from the first- to third-year by DE participation in at least one DE course based upon rurality is different across groups (i.e., city, suburban, town, and rural), and association with DE based upon rurality affects the outcome. This means that there are statistically significant differences based upon rurality between a student who participates in at least one DE course to persist in college from the first- to the third-year.

Data Analysis

This study focused on the observed differences of students who participated in DE before high school completion controlling for gender, race/ethnicity, SES, and rurality. Before analyzing the data, I performed descriptive statistical analyses of the selected DE student sample to understand the data and screen for outliers. Using PST data, X5DUALCRSFLG served as the independent variable, DE, which included dual enrollment data based on courses completed as of June 2016. To identify gender, race/ethnicity, and SES, I used Grade 9 data because this information was suppressed in the college survey and PST data collection. Therefore, the X1SEX, X1RACE, and X1POVERTY variables served as the gender, race/ethnicity, and SES independent variables, respectively. I used the college survey to identify rurality and college persistence. The college survey provided information on the last high school a student attended and college persistence three years after high school. The variable, X4LOCALE, served as the moderating independent variable for rurality, which categorized a students' last high school location as city, suburb, town, or rural. Finally, X4PSENRSTLV was

used as the college persistence dependent variable and included student enrollment status at any institution as of February 2016.

Descriptive Statistics

Using unweighted scores based on the full sample (N = 23,503), the descriptive statistics were as follows: the percentage of males was 50.9% and females were 49%. The percentage of students as categorized by race/ethnicity was as follows: American Indian/Alaska Native, non-Hispanic 0.7%; Asian, non-Hispanic 8.3%; Black/African-American, non-Hispanic 10.4%; Hispanic, no race specified 1.8%; Hispanic, race specified 14.4%; More than one race, non-Hispanic 8.3%; Native Hawaiian/Pacific Islander, non-Hispanic 0.5%; and White, non-Hispanic 51.4%. The percentage of students at or above poverty was 59.8%, and the percentage of students below poverty was 11.4%. The percentage of students based on rurality were City 21.2%, Suburb 22.9%, Town 9.1%, and Rural 73%. The percentage of students who participated in only DE classes was 1.2%, the percentage of students who participated in both DE and postsecondary enrollment courses (not including AP or IB) was 10.9%, and the percentage of students who participated in only postsecondary enrollment courses were 43.1%. The percentage of students as categorized by college enrollment level were as follows: the percentage of students who were not enrolled was 14.3%, the percentage of student who were enrolled in a four-year institution was 32.1%, the percentage of students who were enrolled in a two-year institution was 7.9%, and the percentage of students who were enrolled in a less than two-year institution was 0.6%. The student-level composite or X variables were used because they had the least amount of missing information as compared to using individual student-level variables. Despite using composite variables, data were still

missing. The missing data values had a minimum of .23% and a maximum of 4.28%. Unit non-response or components not applicable had a minimum of 17.78% and a maximum of 28.57%.

Table 2

Unweighted DE Variables

Baseline characteristics	Full sample					
	N	%	Item legitimate skip/NA	Unit non-response	Component NA	Missing
Gender						0.03%
Male	11,973	50.94%				
Female	11,524	49.03%				
Race/Ethnicity						4.28%
Amer. Indian/Alaska Native, non-Hispanic	165	0.70%				
Asian	1,952	8.31%				
Black/African-American non-Hispanic	2,450	10.42%				
Hispanic, no race specified	422	1.80%				
Hispanic, race specified	3,375	14.40%				
More than one race, non-Hispanic	1,941	8.26%				
Native Hawaiian/ Pacific Islander, non-Hispanic	110	0.47%				
White, non-Hispanic	12,082	51.41%				
SES				28.57%		0.23%

At or above poverty	14,062	59.83%				
Below poverty	2,671	11.36%				
Rurality				26.24%		0.77%
City	4,978	21.18%				
Suburb	5,386	22.92%				
Town	2,133	9.08%				
Rural	4,658	19.82%				
DE Participation				17.78%	26.20%	0.82%
Only DE	279	1.19%				
Both DE and PS enrollment courses known	2,567	10.92%				
Only PS enrollment courses known	10,122	43.17%				
College Persistence			18.21%	26.24%		0.38%
Not Enrolled	3,365	14.32%				
Enrolled in a four-year institution	7,553	32.14%				
Enrolled in a two-year institution	1,868	7.95%				
Enrolled in a less-than-two-year institution	139	0.59%				
Enrolled, institution level unknown	40	0.17%				

Note. *N* = 23,503. SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09) public-use data files. Base Year, Update and High School Transcript, Second Follow-up, and Postsecondary Evaluation Transcripts Public-Use Data files.

Missing Data

Because missing data could potentially affect the power, precision, and bias of the estimate of my results, I developed a plan to account for the missing data. First, I had to decide if the data were missing completely at random (MCAR), missing at random

(MAR), or missing not at random (MNAR) (e.g., Little & Rubin, 2019). If missing values were truly MCAR, then most analytic results would not be affected by the excluded survey cases. HSLS:09 codes indicated that data were missing for different reasons such as unit non-response, component not applicable. I concluded that the data were MAR. Common approaches for handling missing data include complete case analysis, pairwise deletion, and imputation. Recent studies suggest multiple imputations is a best practice approach to handling missing data, particularly when using longitudinal data with multiple data points (Allison, 2010; Enders, Keller, & Levy, 2018; Van Buuren, 2018). Multiple imputations fill in the missing data to create a complete analysis dataset while also accounting for the uncertainty of the imputed values (Allison, 2010). The benefit of using multiple imputations is that in addition to restoring the natural variability of the missing values, it incorporates the uncertainty due to the missing data, which results in a less biased statistical inference even in the presence of small sample size or a high number of missing data (Kang, 2013). According to the HSLS:09 codebook, a set of key analytic variables were identified and indicator variables were created to identify the imputed values. I used the HSLS:09 indicator codes to identify and remove the missing data from my selected variables.

After the missing data were removed, the descriptive statistics unweighted scores changed. The sample reduced from $N = 23,503$ to $N = 8,154$. Following an analysis of the descriptive statistics, I conducted a cross-tabulation to inspect the number of cases in each set of variables. Based upon the results, I restricted the "Persistence" variable to only students who were enrolled in a four-year institution or not enrolled. This reduced the sample size from $N = 8,154$ to $N = 7, 013$. I performed another cross-tabulation and

reviewed the results.

Once I examined the data, I dropped "Only DE courses known" from the "DE Participation" variable because of the low number of cases (N = 28, Not Enrolled; N = 95, Enrolled) and kept "Both DE and postsecondary (PS) enrollment courses known" (N = 308, Not Enrolled; N = 1,235, Enrolled), and "Only PS enrollment courses known" (N = 1,415, Not Enrolled; N = 3,932). For Gender, males serve as the reference group in my analysis because I wanted to observe the substantive differences in females as compared to males on the outcome of DE and college persistence (Rivera et al., 2019). Regarding the Race/Ethnicity variable, the measure that indicated "No biological/adoptive/step-parent in the household" was too low to measure, so I dropped the cases from the variable. I then combined Hispanic, race specified (N = 261, Not Enrolled, N = 556, Enrolled) with Hispanic, no race specified (N = 9, Not Enrolled, N = 12, Enrolled) into one category and labeled it "Hispanic." I also combined American Indian/Alaska Native, non-Hispanic (N = 14, Not Enrolled; N = 21, Enrolled); was combined with Native Hawaiian/Pacific Islander, non-Hispanic (N = 6, Not Enrolled; N = 21, Enrolled), and labeled "Other."

I reviewed another cross-tabulation and observed that the sample size reduced from N = 7,013 to N = 6,890. However, I also observed that the "Other" cases were still low (N = 20, Not Enrolled; N = 41, Enrolled); therefore, I dropped the "Other" category as well. This reduced the sample size from N = 6,890 to N = 6,829. The remaining unweighted sample size was as follows: The percentage of males was 45.79% and females were 54.21%. The percentage of students as categorized by race/ethnicity was as follows: Asian, non-Hispanic 9.66%; Black/African-American, non-Hispanic 8.38%;

Hispanic 12.41%; More than one race, non-Hispanic 8.49%; and White, non-Hispanic 61.33%. The percentage of students at or above poverty was 91.26%, and the percentage of students below poverty was 8.74%. The percentage of students based on rurality were City 31.01%, Suburb 31.47%, Town 11.69%, and Rural 25.83%. The percentage of students who participated in both DE and postsecondary enrollment courses (not including AP or IB) was 22.48%, and the percentage of students who participated in only postsecondary enrollment courses was 77.52%. The percentage of students as categorized by enrollment level were as follows: the percentage of students who were not enrolled was 24.94%, and the percentage of student who was enrolled in a four-year institution was 75.06%.

Table 3

Unweighted DE Variables without Missing Data

Characteristics	Sample	
	N	%
Gender		
Male	3,127	45.79%
Female	3,702	54.21%
Race/Ethnicity		
Asian, non-Hispanic	660	9.66%
Black/African American, non-Hispanic	572	8.38%
Hispanic	829	12.14%
More than one race, non-Hispanic	580	8.49%
White, non-Hispanic	4,188	61.33%
SES		

At or above poverty	6,232	91.26%
Below poverty	597	8.74%
Rurality		
City	2,118	31.01%
Suburb	2,149	31.47%
Town	798	11.69%
Rural	1,764	25.83%
DE Participation		
Both DE and PS enrollment courses known	1,535	22.48%
Only PS enrollment courses known	5,294	77.52%
College Persistence		
Did Not Persist	1,703	24.94%
Persisted	5,126	75.06%

Note. *N* = 6,829. SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09) public-use data files. Base Year, Update and High School Transcript, Second Follow-up, and Postsecondary Evaluation Transcripts Public-Use Data files.

Weighting Cases

Several researchers argue that weights should be considered for studies with complex sampling designs and particularly those that employ multilevel models (Cai, 2013; Chen, Elliot, Haziza, Yang, Ghosh, Little, Sedransk & Thompson, 2017). Using weighted totals of variables correct for imperfections in the data that might lead to bias and provide conclusions generalizable to the target population (Kolenikov, 2016). Although the problem of self-selection bias cannot always be solved with the application of post-stratification procedures, the process of adding weights can minimize the effects by adjusting for the proportional over- and underrepresentation of certain populations

(Bethlehem & Stoop, 2007). More importantly, the HSLS:09 Codebook recommended post-stratification weighting to more accurately reflect the population; therefore, weights were used in the regression analysis (Base-Year, p. 162).

Once I reviewed case counts for my variables one last time, then, I recoded each of the selected variables as described below and entered them in the SPSS statistical software version 27 with a complex sample add-on to observe main and moderating effects using weights to ensure population generalizability (HSLS:09 Codebook, Base-Year; Kolenikov, 2016; Kugler, Trail, Dziak, & Collins, 2012). Since this study examines the relationship between DE and college persistence over time, the HSLS:09 codebook suggested using a balanced repeated replication (BRR) weight to estimate longitudinal variance. Moreover, BRR was also the most appropriate method because HSLS:09 is based upon a complex survey design with the use of a stratified two-stage sample design and poststratification and nonresponse weights. BRR is a special form of replicate weights technique for computing standard errors of survey estimates. BRR is a method that provides unbiased estimates of the sampling error arising from complex sample selection procedures. The estimates capture the effects of stratification, clustering, and unequal probabilities of selection (Little & Rubin, 2019). To handle the BRR, an R version 3.6 software extension plug-in was added to the SPSS software. Then I selected the longitudinal weight that included the main effect variables of DE Participation, Gender, Race/Ethnicity, SES, and Rurality, which was W5W1W2W3W4PSTRANS005. These weights were selected because they accounted for all the data collection periods and variables of interest.

Recoded Variables

Below, I discuss the selected student-level variables and the recoding according to the constructs they represent.

College Persistence. The College Persistence dependent variable was created from the college survey data to indicate college student persistence or "Persisted" from the first to the third-year as of February 2016 when a student would have been continuously enrolled in any four-year institution for three years. A student labeled as "Did Not Persist" is one who has left a four-year institution. The measures were as follows: "Persisted" = 1, Enrolled in a four-year institution as of February 2016; and "Did Not Persist" = 0, Not enrolled in a four-year institution as of February 2016.

DE Participation. The DE Participation independent variable was created using PST data to capture any DE courses a student took in high school and received college credit. The measures were coded as "Both DE and PS (Postsecondary) Enrollment Courses Known" = 1, and "Only PS Enrollment Courses Known" = 0. This variable includes any courses taken during high school for postsecondary credit except AP and IB courses.

Gender. The Gender independent variable was selected from the Grade 9 survey data and included two dichotomous measures, male and female. These measures were coded as Female = 1, Male = 0.

Race/Ethnicity. The Race/Ethnicity independent variable was created from Grade 9 survey data. Because prior literature described most students who participate in DE as White, this student population became my referent group. The variables of interest were other racial/ethnic student populations and coded as follows: Group 1: Asian, non-

Hispanic = 1; Group 2: Black/African American, non-Hispanic = 1; Group 3: Hispanic = 1; and Group 4: More than one race, non-Hispanic = 1.

SES. The SES independent variable was selected from the Grade 9 survey data that indicated whether the participating student's family was at, above, or below the 2008 poverty threshold by 100% as defined by the U.S. Census (HSLS:09). The data in this variable were coded as Below Poverty = 1 and At or Above Poverty = 0.

Rurality. The Rurality independent variable was created from the college survey data to indicate the location of the last high school participating students attended before beginning college. The data from this variable included four measures (i.e., city, suburb, town, rural). According to data from the U.S. Department of Civil Rights 2015-16, DE courses and programs are more prevalent in rural areas and, thus, became my referent group. To examine the associations between DE and other locations (city, suburb, and town), I varied the coding as follows: Group 1: City = 1; Group 2: Suburb = 1; Group 3: Town = 1. Rural = 1 with City, Suburb, and Town coded as 0.

Table 4 displays the dependent and independent variable recoding:

Table 4

Student-level Variables and Recoding

Hierarchical Models	Variables	Values	Recoding
Dependent Variable	College Persistence X4PSENRSTLV (4-year institution)	Did Not Persist	0
		Persisted	1
Independent Variable	DE Participation X5DUALCRSFLG	Both DE and PS Courses Known	1
		Only PS Courses Known	0
Independent Variable	Gender X1SEX	Male	0
		Female	1
Independent Variable	Race/ethnicity* X1RACE	Asian, non-Hispanic	(0, 1)
		Black/African-American, non-Hispanic	(0, 1)
		Hispanic	(0, 1)
		More than one race, non-Hispanic	(0, 1)
		White, non-Hispanic	0
Independent Variable	SES X1POVERTY	At or Above Poverty	0
		Below Poverty – 100% poverty threshold	1
Independent Variable	Rurality* X4LOCALE	City	(0, 1)
		Suburb	(0, 1)
		Town	(0, 1)
		Rural	0

Notes. DE = Dual Enrollment. The asterisk (*) indicates variables of interest that vary (coding changed from 1 or 0) to observe different group effects.

Once the recoding was completed, a binary logistic regression was conducted to measure the relationship between the independent variable of DE Participation and the dependent variable of College Persistence, controlling for gender, race/ethnicity, SES, and rurality. Prior literature guided the selection of the sociodemographic models of gender, race/ethnicity, SES, and rurality as factors likely to influence a high school student's participation in DE and third-year college persistence (Agger et al., 2018; Ma et al., 2016). The main effects of the model examined the dependent variable of College Persistence and independent variable of DE Participation, controlling for the independent variables of Gender, Race/Ethnicity, SES, and Rurality. Nine sets of interaction terms were tested through the binary logistic regression model to determine whether the relationship between DE participation and college persistence changed when another variable (i.e., gender, race/ethnicity, SES, and rurality) was introduced. The interaction terms were: (a) DE and Gender (Female); (b) DE and Race/Ethnicity (Asian); (c) DE and Race/Ethnicity (Black/African American); (d) DE and Race/Ethnicity (Hispanic); (e) DE and Race/Ethnicity (more than one race); (f) DE and SES (below poverty); (g) DE and Rurality (City); (h) DE and Rurality (Suburb); and (i) DE and Rurality (Town). The formulas that guide these effects are as follows:

Main Effects

*Logit (*College Persistence*)* = b_0 (Constant) + b_1x_1 *(*DE Participation*)* + b_2x_2 (Gender) + b_3x_3 (Race/Ethnicity) + b_4x_4 (SES) + b_5x_5 (Rurality) + ∈.

Moderating Effects – DE Participation x Gender

Logit (College Persistence) = b_0 (Constant) + b_1x_1 *(*DE Participation*)* + b_2x_2 (Gender) + b_3x_3 (Race/Ethnicity) + b_4x_4 (SES) + b_5x_5 (Rurality) + $b_6x_1\ x_2$ (DE Participation x Gender) + ∈.

Moderating Effects – DE Participation x Race/Ethnicity

Logit (College Persistence) = b_0 (Constant) + b_1x_1 *(*DE Participation*)* + b_2x_2 (Gender) + b_3x_3 (Race/Ethnicity) + b_4x_4 (SES) + b_5x_5 (Rurality) + $b_6x_1\ x_3$ (DE Participation x Race/Ethnicity) + ∈.

Moderating Effects - DE Participation x SES

Logit (College Persistence) = b_0 (Constant) + b_1x_1 *(*DE Participation*)* + b_2x_2 (Gender) + b_3x_3 (Race/Ethnicity) + b_4x_4 (SES) + b_5x_5 (Rurality) + $b_6x_1\ x_4$ (DE Participation x SES) + ∈.

Moderating Effects - DE Participation x Rurality

Logit (College Persistence) = b_0 (Constant) + b_1x_1 *(*DE Participation*)* + b_2x_2 (Gender) + b_3x_3 (Race/Ethnicity) + b_4x_4 (SES) + b_5x_5 (Rurality) + $b_6x_1\ x_5$ (DE Participation x Rurality) + ∈.

Table 5 demonstrates the models that investigated the interactions:

Table 5

College Persistence Model Interactions

Type of Interaction	Block	Variables
Main Effects	Block 1	DE Participation (Persisted, group of interest)
	Block 2 (Demographics)	Gender (Female, group of interest)
		Race/Ethnicity* • Asian • Black/African American • Hispanic • More than one race • White (referent group)
		SES (Below poverty, group of interest)
	Block 3	Rurality* • City • Suburb • Town • Rural (referent group)
Moderating Effects	Block 4	DE Participation x Gender
Moderating Effects	Block 4	DE Participation x Race/Ethnicity • Asian • Black/African American • Hispanic • More than one race
Moderating Effects	Block 4	DE Participation x SES
Moderating Effects	Block 5	DE Participation x Rurality • City • Suburb • Town

Notes. DE = Dual Enrollment. The asterisk (*) indicates variables of interest that vary (coding changed from 1 or 0) to observe different group effects.

The purpose of this chapter was to discuss the method for examining and analyzing differences between DE and first- to third-year college persistence, controlling for gender, race/ethnicity, SES, and rurality. The first sections of this chapter included the processes used to identify the appropriate data sources that represented the independent and dependent variables for the research question of this study. Once these data were finalized, the HSLS:09 variables and weights were determined. The variables were then re-coded and analyzed. Finally, a binary logistic regression was completed. Chapter Four will present the results from the regression analysis. It will also begin to link the findings to the primary research question.

CHAPTER FOUR

RESULTS

This chapter presents the findings from the study to determine whether DE influences the likelihood of first- to third-year college persistence, controlling for gender, race/ethnicity, SES, and rurality. As described in Chapter Three, I conducted a binary logistic regression to examine the main and moderating effects between the independent and dependent variables as described below.

Descriptive Statistics

After initially reviewing the descriptive statistics of the full sample (N = 23,503), there was missing data that could potentially affect the precision, power, and bias of my sample. Prior literature suggested using multiple imputations to remove the missing data (Allison, 2010; Enders et al., 2018; Van Buuren, 2018). The HSLS:09 Codebook identified the specific items that were imputed; therefore, I used this coding to remove missing data from each of the selected variables. After reviewing several cross-tabulations to determine case numbers, I subsequently restricted the college persistence variable to include only students who were enrolled in a four-year institution or not enrolled. When I examined the DE Participation variable, I dropped the measure that included "Only DE courses known" due to low case numbers (N = 28, Not Enrolled; N = 95, Enrolled) and kept "Both DE and postsecondary (PS) enrollment courses known" (N = 308, Not Enrolled; N = 1,235, Enrolled), and "Only PS enrollment courses known" (N = 1,415, Not Enrolled; N = 3,932). I conducted additional cross-tabulations on the

race/ethnicity category to ensure that I had enough cases to examine. First, I dropped the measure that indicated "No biological/adoptive/step-parent in the household" because the cases were too low to be examined. I then combined Hispanic, race specified (N = 261, Not Enrolled, N = 556, Enrolled) with Hispanic, no race specified (N = 9, Not Enrolled, N = 12, Enrolled) into one category and labeled it "Hispanic." I also combined American Indian/Alaska Native, non-Hispanic (N = 14, Not Enrolled; N = 21, Enrolled); was combined with Native Hawaiian/Pacific Islander, non-Hispanic (N = 6, Not Enrolled; N = 21, Enrolled), and labeled "Other." However, a subsequent cross-tabulation revealed that this category was still low (N = 20, Not Enrolled; N = 41, Enrolled); therefore, I dropped the "Other" category as well.

The final unweighted descriptive statistics as described in Chapter Three indicated as follows: the percentage of females was slightly greater than the percentage of males (54.21% and 45.79%, respectively); the percentage of White students were substantially greater than the percentage of other race/ethnicities (Asian, non-Hispanic, 9.66%; Black/African-American, non-Hispanic, 8.38%; Hispanic [including Hispanic, no race specified and Hispanic, race specified] 12.14%; More than one race, non-Hispanic, 8.49%); and White, non-Hispanic (61.33%). The percentage of "At or Above Poverty" students was greater than the percentage of students "Below Poverty" (91.26% and 8.74%, respectively) as identified by the U.S. Census 100% poverty threshold. In terms of Rurality, the percentage of suburban students was greater than the percentage of students from other areas; However, rural students had the second-largest percentage of students (Suburb, 31.47%; Rural 25.83%; City, 31.01%; Town, 11.69%). In terms of DE Participation, more than half of the students took "Only PS enrollment courses known;"

A smaller percentage of students took “Only PS enrollment courses known” (77.52% and 22.48%, respectively). Lastly, the percentage of students who persisted from the first- to the third-year at a four-year institution was greater than the percentage of students who did not (Persisted, 75.06%; Did Not Persist, 24.94%).

Regression Model

Logistic regression was used to examine my research question of whether there was an influence of DE on first- to third-year college persistence, controlling for gender, race/ethnicity, SES, and rurality. First, I examined the main effects between the independent variables, (i.e., DE, gender, race/ethnicity, SES, and rurality) and the dependent variable (college persistence). Then, I included the moderating effects of gender, race/ethnicity, SES, and rurality to assess whether the relationship between DE and college persistence changed.

Using the sample derived from the HSLS:09 survey data, the predictors of DE participation, gender, race/ethnicity, SES, and rurality were used to determine the likehood of college student persistence from the first- to the third-year in any four-year institution. Based on hierarchical regression, five variable blocks were included in the model: Block 1 (DE Participation); Block 2 (Demographics including Gender, Race/ethnicity [Asian, Black/African American, Hispanic, More than one race], and SES); Block 3 (Rurality [city, suburb, and town]); Block 4 (Moderating effects: DE x Gender, DE x Race/ethnicity [Asian, Black/African American, Hispanic, More than one race], and DE x SES); Block 5 (Moderating effects: DE x Rurality [city, suburb, and town]) including the survey weight W5W1W2W3W4PSTRANS005 to get a more

accurate representative sample of the general population . Once the blocks were entered, and the regression finalized, the data were analyzed.

Regression Model Main Effects

DE and College Persistence

Before the first independent variable, DE Participation was added to the regression model, the Case Processing Summary indicated that the number of cases included in the analysis was N = 3,068 with no missing data. After the DE Participation variable was added, the Omnibus Tests of Model Coefficients indicated that the predictor (DE Participation) was significant with the chi-square, χ^2 (1, N = 3,068) = 35,785.70, p < .05. Another way of evaluating the effectiveness of the regression model to calculate the strength of the relationship between the predictor variable and the outcome variable was through the Cox & Snell R Square and Nagelkerke R Square (Cox, Snell, 1968; Nagelkerke, 1991). The Classification Table indicated that the model did a good job of predicting those who persisted as compared to those who did not persist (100% versus 0, respectively). Overall, 65.8% of the students were correctly classified. Next, the Variables in the Equation were examined. The results of the unstandardized coefficient indicated that DE Participation decreased the log-odds of persisting by .687, p < .05. Controlling for other variables, this coefficient indicated that the log-odds were more likely for a DE student to persist from the first- to the third-year of college than a non-DE student (see Appendix A1).

Demographics

When the independent variables of Gender, Race/Ethnicity, and SES were added to the model in Block 2, the Omnibus Tests of Model Coefficients indicated that the

predictors of DE Participation, Gender, Race/ethnicity, and SES were all statistically significant with the chi-square, χ^2 (7, N = 3,068) = 153,517.11, $p < .05$. This indicated that the model improved by including the additional demographic variables. The Cox & Snell R Square and Nagelkerke R Square measures indicated that between 7.4% and 10.2% of the variance in college persistence was explained by the model with the independent variables of DE Participation, controlling for gender, race/ethnicity, and SES. This meant that 92.6% to 89.8% of the factors that lead to college persistence were still unexplained even after adding the demographics of gender, race/ethnicity, and SES variables to the model. Overall, 68.5% of the students were correctly classified by this model. The results from the Variables in the Equation unstandardized coefficients indicated that being a female increased the log-odds of persisting by .477, $p < .05$.

Rurality

When the independent variables of rurality (city, suburb, and town) were added to the model in Block 3, the Omnibus Tests of Model Coefficients were significant and indicated the chi-square was χ^2 (10, N = 3,068) = 177,696.28, $p < .05$. This indicated that the model improved by including the additional rurality variables. The Model Summary -2 Log-likelihood statistic was 2,391,511.79. The Classification Table indicated that the model did a good job in predicting those who persisted as compared to those who did not persist (92.2% versus 22.3%, respectively). The results from the Variables in the Equation unstandardized coefficients indicated that being in a suburb had more increased log-odds of persisting than being in a city (Suburb, .491, $p < .05$; City, .151, $p < .05$). However, being in a town had decreased log-odds for persisting by -.289, $p < .05$.

Last, Block 5 was entered into the model to examine the moderating effects of rurality with the other model predictors. The Omnibus Tests of Model Coefficients were significant and indicated the chi-square was χ^2 (10, N = 3,068) = 177,696.28, $p < .05$. This indicated that the model improved by including the additional rurality variables. Subsequently, Block 4 and 5 included the moderating variables and were entered into the model. Specifically, Block 4 introduced the moderating variables of DE Participation x Gender, DE Participation x Race/Ethnicity, and DE Participation x SES into the model. The Omnibus Tests of Model Coefficients indicated that the model was statistically significant with the chi-square, χ^2 (16, N = 3,068) = 189,110.511, $p < .05$.

Regression Coefficient Rurality Results

DE Participation x Rurality (moderating effects). Lastly, the moderating effects of DE Participation with rurality, which included city, suburb, town, and rural were placed into the model. The Omnibus Tests of Model Coefficients indicated that the model was statistically significant with the chi-square, χ^2 (19, N = 3,068) = 199,771.039, $p < .05$. The Cox & Snell R Square and Nagelkerke R Square indicated that between 9.5% and 13.1% of the variance in college persistence was explained by adding the moderating effects of DE Participation with Gender, Race/Ethnicity, and SES. This meant that between 90.5% and 86.9% of the factors that lead to college persistence were still unexplained. However, adding Rurality explained more of the variance than the other variables. The Hosmer and Lemeshow Test indicated a chi-square of χ^2 (8, N = 3,068) = 17936.525, $p < .05$. The Classification Table indicated that the model did a good job of predicting those who persisted as compared to those who did not persist (90.9% versus 25.7%, respectively). Overall, 68.6% of the students were correctly classified. Next, the

Variables in the Equation were examined. The results of the unstandardized coefficient indicated the following:

DE Participation x Rurality (City). DE Participation and Rurality (City) decreased the log-odds of persisting from the first- to third-year of college by -.387, $p < .05$. This meant that taking DE in the city is a moderating effect or weakens the relationship between DE and college persistence more than taking DE in suburb, town, or rural locations.

DE Participation x Rurality (Suburb). DE Participation and Rurality (Suburb) decreased the log-odds of persisting from the first- to third-year of college by -.297, $p < .05$. This meant that taking DE in the suburb is a moderating effect or weakens the relationship between DE and college persistence as compared to other locations including city, town, and rural.

DE Participation x Rurality (Town). DE Participation and Rurality (Town) increased the log-odds of persisting from the first- to third-year of college by .790, $p < .05$. This meant that taking DE in a town is a moderating effect or enhances the relationship between DE and college persistence more than taking DE in city, suburb, or rural locations.

The results from the moderating effects regression coefficients reflect the following:

DE Participation x Rurality (City). A one-unit increase in Block 5 (DE Participation x Rurality [City]) is a -.387 decrease in the regression coefficient of Block 1 (DE Participation) when controlling for other variables. This meant that the log-odds

were reduced for a student taking DE in the city to persist from the first- to the third-year of college when compared to a student taking DE in suburb, town, and rural locations.

DE Participation x Rurality (Suburb). A one-unit increase in Block 5 (DE Participation x Rurality [Suburb]) is a -.297 decrease in the regression coefficient of Block 1 (DE Participation) when controlling for other variables. This means that the log-odds were reduced for a student taking DE in the suburb to persist from the first- to the third-year of college when compared to students taking DE in city, town, and rural locations.

DE Participation x Rurality (Town). A one-unit increase in Block 5 (DE Participation x Rurality [Town]) is a .790 increase in the regression coefficient of Block 1 (DE Participation) when controlling for other variables. This means that the log-odds were enhanced for a student taking DE student in a town to persist from the first- to the third-year of college when compared to students taking DE in city, suburb, and rural locations.

The main effects model results are summarized in the formula below:

Regression Coefficient Demographic and Rurality Logit Model

Logit (College Persistence) = .653 (Block 0 - Constant) + .687 (Block 1 - DE Participation) + .477 (Block 2 - Gender [Female]) + .968 (Block 2 - Race/Ethnicity [Asian]) -.347 (Block 2 - Race/Ethnicity [Black/African American]) – .494 (Block 2 - Race/Ethnicity [Hispanic]) - .566 (Block 2 - Race/Ethnicity [More than one race]) – 1.162 (Block 2 - SES [Below Poverty]) + .151 (Block 3 – Rurality [City]) + .491 (Block 3 - Rurality [Suburb]) - .289 (Block 3 - Rurality [Town]) + .146 (DE Participation x Gender) + .079 (DE Participation x Race/Ethnicity [Asian]) + .126 (DE Participation x

Race/Ethnicity [Black/African American]) + .547 (DE Participation x Race/Ethnicity [Hispanic]) + .151 DE Participation x (Race/Ethnicity [More than one race]) + 1.070 (DE Participation x SES [Below Poverty]) -.387 (DE Participation x Rurality [City]) -.297 (DE Participation x Rurality [Suburb]) + .790 (DE Participation x Rurality [Town]) + ∈.

The regression coefficients from the moderating effects of Model 1 after including the independent variables of DE Participation x Gender, DE Participation x Race/Ethnicity, DE Participation x SES, and DE Participation x Rurality were all statistically significant at the .05 alpha level, p <. 05. Therefore, I rejected the null hypothesis that there was no relationship between the dependent and independent variables. I accepted the alternative hypothesis that the moderating groups were statistically different from zero, and there was a relationship between the dependent and independent variables (Osborne, 2006).

Table 6 presents a summary of the results of the regression coefficient analyses.

Table 6

Model Results of College Persistence for DE Students

Outcome	Model	β	SE
Main Effects			
DE Participation	Main Effects	.687	.004
Gender (Female)	Main Effects	.477	.003
Race/Ethnicity			
Asian	Main Effects	.968	.010
Black/African American	Main Effects	-.347	.005
Hispanic	Main Effects	-.494	.004
More than one race	Main Effects	-.566	.006
SES (Below Poverty)	Main Effects	-1.162	.005

Rurality			
City	Main Effects	.151	.004
Suburb	Main Effects	.491	.004
Town	Main Effects	-.289	.005
Moderating Effects			
DE x Gender (Female)	Moderating Effects	.146	.008
Race/Ethnicity			
DE x Asian	Moderating Effects	.079	.028
DE x Black/African American	Moderating Effects	.126	.014
DE x Hispanic	Moderating Effects	.547	.013
DE x More than one race	Moderating Effects	.151	.017
DE x SES (Below Poverty)	Moderating Effects	1.070	.015
Rurality			
DE x City	Moderating Effects	-.387	.010
DE x Suburb	Moderating Effects	-.297	.011
DE x Town	Moderating Effects	.790	.012

Note: DE = Dual Enrollment. SE = standard error.
SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09) public-use data files. Base Year, Update and High School Transcript, Second Follow-up, and Postsecondary Evaluation Transcripts Public-Use Data files.

Chapter Four described the results from the binary logistic regression conducted to analyze the influence of DE on first- to third-year college persistence, controlled by gender, race/ethnicity, SES, and rurality. The results from the main effects indicated that the independent variables of DE Participation, Gender, Race/Ethnicity, SES, and Rurality were all statistically significant at the .05 alpha level, $p <. 05$. Therefore, I rejected the null hypothesis and accepted the alternative hypothesis that the main effects groups were

statistically different from zero, and there was a relationship between the dependent and independent variables. I then observed the moderating effects of the variables with the dependent variable. The results from the moderating effects indicated that the independent variables of DE Participation x Gender, DE Participation x Race/Ethnicity, DE Participation x SES, and DE Participation x Rurality were all statistically significant at the .05 alpha level, $p <. 05$. Therefore, I rejected the null hypothesis and accepted the alternative hypothesis that the groups were statistically different from zero, and there was a moderating effect between the dependent and independent variables. Chapter Five presents a discussion of the findings and links the results to the research question.

CHAPTER FIVE

DISCUSSION

Although rural students graduate from high school at higher rates than the national average, the percentages of students who enroll, persist, and complete a college degree are still lower than their urban and suburban peers (Wells, Manly, Kommers, Kimball, 2019). Numerous obstacles have historically kept rural youth from earning degrees beyond high school. Among some of these barriers include a dwindling population as agricultural and manufacturing jobs disappear and leaving lower-income and less educated residents (U.S. Economic Research Service, 2017). Many students in these areas attend secondary schools that are more geographically isolated, have smaller tax revenues and budgets, and a lack of qualified teachers than nonrural schools (Cromartie, 2017; Johnson et al., 2019; Mattingly, 2020; U.S. Economic Research Service, 2017). Yet rural students have a strong attachment to their communities that makes moving away from a difficult choice even though their educational opportunities may be limited (Hillman, 2016). As a result, many educational leaders have begun offering DE even more than AP or IB to lessen the effects of these issues and help promote rural student college persistence and degree completion (U.S. Department of Education, Civil Rights Data Collection, 2015-16). Studies indicate that DE courses help students by increasing academic rigor, easing the transition between high school and college, saving college tuition because of reduced or waived DE course costs, and decreasing time to college degree attainment (Barnett et al., 2014; Kilgore et al., 2017;

Partridge et al., 2020). Moreover, educators encourage DE over AP or IB because they view DE programs as a strategy to improve college preparedness and promote postsecondary access for underrepresented, disadvantaged students because it does not require the passing of a test for a student to receive college credit (Kryst, Kotok, & Hagedorn, 2018). Still, access to DE courses is stratified by gender, race/ethnicity, SES, and location or rurality. Regarding gender, studies indicate that females participate in advanced coursework and attend college at greater rates than males. Yet DE participation appears to be contrary to this trend with males being far more likely to participate in DE than females (U.S. Department of Education, Civil Rights Data Collection, 2015-16). Regarding race and ethnicity, about one in four students in rural areas are students of color. Nevertheless, most rural students participating in DE courses and programs are White (U.S. Department of Education, Civil Rights Data Collection, 2015-16). Further, higher-SES students enroll in DE than lower-SES students even though research indicates that low-SES students may benefit more from DE than middle or high-SES students (An, 2013; An et al., 2015). Therefore, my research question was to determine to what extent does dual enrollment influence first- to third-year college persistence, controlling for gender, race/ethnicity, socioeconomic status, and rurality.

Although extensive literature examines DE courses and programs, most of the research focuses on singular DE programs or institutions rather than a national scope (e.g., Hunter et al., 2019; Pierson et al., 2017). This study adds to the literature on DE and rurality by using the most current NCES national data, HSLS:09, to determine whether DE influences the likelihood of first- to third-year college persistence in a four-year institution, controlling for gender, race/ethnicity, SES, and rurality. To address this

research question, I adapted Tinto's 1997 *Classroom as Communities* SIM to determine variables as related to college persistence. HSLS:09 student data sources (i.e., survey data, high school transcripts, and postsecondary transcripts) were then inspected and selected for survey students beginning in Grade 9, Grade 11, Grade 12, and the first three years of college. Once the appropriate variables were selected, the information was separated into hierarchical blocks, which included DE Participation (those who participated in DE versus those who did not participate in DE), Gender, Race/Ethnicity (Asian, Black/African American, Hispanic, and more than one race), SES (below poverty versus at or above poverty), and Rurality (city, suburb, town, and rural). Then, the blocks were analyzed using a binary logistic regression to investigate the research question. The following section includes a discussion of the findings, limitations of the study, implications for stakeholders, recommendations for future research, and a conclusion.

Summary of the Findings

DE Participation and College Persistence

Main Effects. First, the main effects regarding the influence of DE participation on college persistence, controlling for gender, race/ethnicity, and SES moderated by rurality was examined. A summary of the results from the logistic regression reflected the following: When the independent variable of DE Participation was added to the model, the relationship to the dependent variable of college persistence increased (.687, $p < .05$). This indicated that a DE student was more likely to persist from the first- to third-year of college than a non-DE student. Once the independent variable of gender was added to the model, the relationship of DE participation to the dependent variable of college persistence increased again (.477, $p < .05$). This indicated that a female DE

student was also more likely to persist from the first- to the third-year of college as compared to a male DE student. With the inclusion of the independent variable of Race/Ethnicity, the following results were observed: Asian DE students had the greatest likelihood to persist from the first- to the third-year of college as compared with other races of DE students (.968, $p < .05$). However, Black/African American DE students had a slightly higher likelihood of persisting than Hispanic or more than one race DE students, respectively (Black/African American, -.347, $p < .05$; Hispanic, -.494, $p < .05$, and more than one race, -.566, $p < .05$). Although low-SES DE students were less likely to persist when compared with middle to high-SES DE students (-1.162, $p < .05$), the results of the moderating effects suggested that participating in DE might have the greatest influence on low-SES students (1.070, $p < .05$). In terms of rurality, DE students who took courses in a suburb or city were more likely to persist when compared to DE students who took courses in town or rural locations (Suburb, .491, $p < .05$; City, .151, $p < .05$), controlling for other variables. Yet, DE students who took courses in a town were less likely to persist as compared to DE students who took courses in a rural location when controlling for other variables (Town, -.289, $p < .05$). Overall, the results from the main effects of the independent variables of DE Participation, Gender, Race/Ethnicity, SES, Rurality, and the dependent variable of college persistence revealed that the groups were statistically significant, and there were relationships between the dependent and independent variables. Therefore, the alternative hypothesis was accepted. There was a statistically significant difference in first- to third-year college persistence between students who participate in dual enrollment and students who participate in other college credit courses, after controlling for gender, race/ethnicity, socioeconomic status, and

rurality.

Moderating Effects. When the moderating effects regarding the influence of DE participation on college persistence, controlling for gender, race/ethnicity, and SES moderated by rurality were examined, a similar pattern emerged. Once the independent variable of DE Participation x Gender was added to the model, the relationship between DE participation and college persistence increased (.146, $p < .05$). This meant that being a female is a moderating effect or enhances the relationship between DE and college persistence as compared to males. Once the variables of Race/Ethnicity were added, the following observations were made: DE Participation and Race/Ethnicity (Asian) increased the relationship of DE participation to the dependent variable of college persistence (.079, $p < .05$). This meant that being Asian is a moderating effect or enhances the relationship between DE and college persistence as compared to other races. When the independent variable of DE Participation x Race/Ethnicity (Black/African American) was added, the relationship between DE participation and college persistence increased by (.126, $p < .05$). This meant that being Black/African American is a moderating effect or enhances the relationship between DE and college persistence as compared to other races. After the independent variable of DE Participation and Race/Ethnicity (Hispanic) was added, the relationship between DE participation and college persistence increased by (.547, $p <.05$). This meant that being Hispanic is a moderating effect or enhances the relationship between DE and college persistence more than it does as compared to other races (i.e., Asian, Black/African American, and more than one race). Adding the independent variable of DE Participation x Race/Ethnicity (more than one race) also increased the relationship between DE participation and college

persistence increased by (.151, $p < .05$). Also, adding the independent variable of DE Participation x SES to the model, the relationship between DE participation and college persistence increased by (1.070, $p < .05$). For rurality, a different pattern emerged with the following results: adding the independent variable of DE Participation x Rurality (City) decreased the relationship between DE participation and college persistence by (-.387, $p < .05$). This meant that taking DE in the city is a moderating effect or weakens the relationship between DE and college persistence more than taking DE in suburb, town, or rural locations. Similarly, adding the independent variable of DE Participation x Rurality (Suburb) also decreased the relationship between DE participation and college persistence by (-.297, $p < .05$). This meant that taking DE in the suburb is a moderating effect or weakens the relationship between DE and college persistence as compared to other locations including city, town, and rural. Yet, adding the independent variable of DE Participation x Rurality (Town) the increased relationship between DE participation and college persistence by (.790, $p < .05$). This meant that taking DE in a town is a moderating effect or enhances the relationship between DE and college persistence more than taking DE in city, suburb, or rural locations.

Discussion of the Findings

Advocates of DE contend that students who participate in DE courses and programs have higher GPAs, may take the courses at reduced costs, and graduate at greater rates than those who do not participate in such courses (e.g., Freismuth, 2017; Hunter et al., 2019; Grubb et al., 2017; Warren, 2019). Further, many rural schools and school district leaders offer DE over AP or IB because they view DE programs as a way to improve college preparedness and promote postsecondary access for disadvantaged

students since it does not require the passing of a test for a student to receive college credit (Kryst et al., 2018). Still, some critics argue that DE courses are often taught in high schools by high school instructors who may not be qualified to teach college-level courses. Moreover, fears that an ill-prepared DE instructor may be teaching the courses have even greater possible repercussions as more DE programs target low-income who struggle academically or are from historically underrepresented populations.

Before I examined the HSLS:09 data, I theorized that taking high school DE in a rural environment would provide female, minority, low-SES students with a postsecondary experience that gave them a unique advantage in first- to third-year college persistence over male, White, middle to high-SES, nonrural DE peers. This study found that there was a significant difference in first- to third-year college persistence between students who participate in dual enrollment and students who participate in other college credit courses (not including AP and IB) after controlling for gender, race/ethnicity, socioeconomic status, and rurality. Based on the indicated findings, the following conclusions were made:

1. DE students have a greater likelihood to persist from the first- to the third-year of college as compared to non-DE students.
2. Female DE students have a greater likelihood to persist from the first- to the third-year of college as compared to male DE students.
3. Although minority (Black/African American, Hispanic, and more than one race) students have less of a likelihood to persist from the first- to the third-year of college as Asian and White students, they do have an increased likelihood to persist than Hispanic and more than one race DE students. Yet,

Hispanic DE students had the greatest effect on the relationship of DE to first- to third-year college persistence as compared to other races of DE students.

4. Similarly, low-SES DE students have less advantage to persist from the first- to the third-year of college over the middle- or high-SES DE students. However, low-SES DE students had the greatest effect on the relationship of DE to first- to third-year college persistence when compared to DE students as categorized by gender, race/ethnicity, SES, and rurality.
5. DE students who took courses in a rural location were less likely to persist when compared to DE students who took courses in city or suburb locations, controlling for other variables; however, they were more likely to persist as compared to DE students who took courses in a town when controlling for other variables. Nevertheless, DE students who took DE in a town had the greatest effect on the relationship of DE to first- to third-year college persistence as compared to other locations of DE students.

As prior research suggests, this study also indicates that DE participation has a positive effect on college persistence, controlling for gender, race/ethnicity, SES, and rurality. The focus for this study was to examine whether participating in DE courses or programs gave female, White, low-SES, rural students an increased likelihood to persist in college from the first- to third-year over comparison groups. Yet, the correlations from this study indicate that female, Asian/White, middle- to high-SES, students who took DE courses in a city or suburb are the most likely to persist from the first- to third-year of college when they participate in DE courses and programs. Even though data indicated that females do not participate in DE at the same rate as males, they are more likely to

persist from the first- to the third-year when they participate in DE. As related to SES, low-SES students had the greatest influence on the relationship of DE to college persistence, even though they are less likely to persist from first- to third-year when compared to middle- to high-SES peers. Still, the main and moderating effects for low-SES students were significant with the main effect being negative (-1.162, $p < .05$) but the moderating effect being positive (1.070, $p < .05$). This meant that participating in DE courses while in high school positively influenced low-SES college persistence from first- to third-year as compared to middle- or high-SES. With race/ethnicity, Asian/White students were more likely to persist from the first- to the third-year. However, Black/African American students were slightly more likely to persist as compared to Hispanic and more than one race students. Nevertheless, Hispanic students had the greatest influence on the relationship of DE to college persistence as compared to other races. Moreover, the main and moderating effects of race/ethnicity (Asian, Black/African American, Hispanic, and more than one race) were all significant with the moderating effects being positive (Asian, .079, $p < .05$; Black/African American, .126, $p < .05$, Hispanic, .547, $p < .05$; more than one race, .151, $p < .05$). This meant that participating in DE courses while in high school positively influenced minority college persistence from first- to third-year as compared to Whites. Concerning rurality, DE students who took courses in a rural or town location were less likely to persist in college from first- to the third-year as compared to those participating in a city or suburb, However, the moderating effects indicated that participating in high school DE courses in a town greatly influenced college persistence from first- to third-year even more than living in a city, suburb, or rural location (Town, .790, $p < .05$).

Implications of the Findings

Numerous rigorous research studies have found that DE leads to multiple positive outcomes such as: academically and socially preparing students for college; increasing college enrollment and persistence; strengthening academic performance; and improving college completion (e.g., An, 2013; Hughes et al., 2012). Yet, research regarding long-term college persistence in a four-year institution, particularly related to rural students is limited to nonexistent.

Drawing upon research from Tinto's 1997 SIM, this study investigated how DE, controlling for gender, race/ethnicity, SES, and rurality shape students' first-to third-year college persistence on their quest to complete a degree. Previous research has shown that a rigorous high school curriculum is the single most important predictor of success in postsecondary education (Adelman, 1999, 2006). Consistent with prior literature, the findings from this study suggest that a DE student has an increased likelihood of persisting from the first year of college to the third-year as compared to a non-DE student. While educational disparities still exist for DE students who are low-SES, minority or live in a rural area or town, this study indicates that participating in DE courses and programs may help reduce those educational differences. Further, this study suggests that DE courses and programs might be especially important for rural students and students from low-income households. For example, DE can help rural students overcome unique hurdles (such as living farther away from four-year colleges) and transition into the college environment (Hillman, 2016; Tinto, 1997). DE programs might also reduce the financial burden of pursuing a college degree for students from a low-income household, by enabling them to earn college credits that are free, subsidized, or

reduced than the typical cost at a four-year college. Previous research indicates that the influence of DE on postsecondary degree attainment is greater for students from low-income households than for students from middle- to high-income households (Berger et. al., 2013). The results from this research indicate that DE may hold potential for positively impacting minority students as well.

In sum, this research which examines whether DE influences first- to third-year college persistence, controlling for gender, race/ethnicity, SES, and rurality at a national level is both timely and important. Consistent with prior literature, this study indicates that completing advanced academic coursework in high school such as DE is more important to college achievement than family relationships, SES, or geographic location (e.g., Adelman, 1999, 2006; Byun et al., 2015). While previous research provided a glimpse on the short-term (i.e., first- to second-year) outcomes of DE participants, this study adds to the understanding of the long-term (i.e., first- to third-year) outcomes of DE participants by providing a closer analysis of the effects of DE controlling for race/ethnicity, SES, and rurality. Not only does the research support these benefits for rural DE students, but it also has implications for students from other underrepresented backgrounds on their journey to a postsecondary degree.

Limitations of the Study

This study has several limitations. One limitation was that this study used publicly accessible data rather than restricted. Despite the richness of the HSLS:09 public data, selecting variables to align with the research question of this study was challenging. This issue resulted in some modifications of the study to fit the data. For example, this study defines college persistence as students who are enrolled in college from the first- to third-

year, unlike prior studies that define college persistence as students who are enrolled in college from the first- to second year. Although the results from studying first- to third-year persistence are valuable, the study could not examine first- to second-year persistence as a comparison group. The available variables only allowed for examination of student persistence according to the years when the HSLS:09 participant group was studied (i.e., first- to third-year in college). Another limitation was that the data used in this study was from secondary sources, primarily student self-reported surveys. Although HSLS:09 collects information from transcripts, institution records, and national databases, the study relied mostly on information reported from the students which can affect variability in comprehension, memory retrieval, and reliability (Rosen, Porter, & Rogers, 2017). Lastly, DE courses may have self-selection bias as students may select themselves into a course and can limit the sample because they do not represent the entire population. To minimize this effect, I weighted the variables and also used BRR to provide unbiased estimates of the sampling error that arise from complex sample selection procedures and also make the sample more representative of the general population.

Despite these limitations, the study had several strengths. This study provides a national perspective to the existing literature on DE as related to SES, rurality, and college persistence by using the extensive HSLS:09 dataset. As HSLS:09 is the most current NCES study, this research offers more current information about the influence of DE on student outcomes to educators and policymakers who are responsible for making funding decisions. Finally, this study gives high school students and their families, particularly those who live in rural locations, the knowledge that may help them when

deciding on a program that can provide students with greater potential for enrolling, persisting, and graduating from college with a postsecondary degree.

Implications for DE Stakeholders

Educational Leaders and Policymakers

Overall, this study indicated that student populations as categorized by gender, race/ethnicity, SES, and rurality all experienced increased likelihoods to persist from the first- to third-year in college. For educational leaders and policymakers who struggle with deciding which advanced courses to implement in rural schools and school districts, this study indicates that DE courses and programs provide an important resource for rural students who have limited opportunities for college. The results indicate that minority DE students who live in towns and rural locations are less likely to persist in college from the first- to third-year than Asian, White, city, and suburban students. However, the effects of DE on college persistence are greatest for minority DE students who live in towns and rural locations. This suggests that federal, state, and local educational agencies might want to explore more strategies to expand DE access in towns and rural areas, such as offering courses online or at locations in addition to high school or college campuses (Zinth, 2015). States may want to identify and address barriers that prevent DE participation such as transportation to college campuses or inadequate technology access for online courses. Also, educational leaders and policymakers might focus DE program expansion efforts on schools and school districts with higher racial/ethnic minority and economically disadvantaged student populations. Because DE certified teachers can be a barrier to offering DE courses in schools, especially high poverty schools, school administrators should consider whether potential teacher hires have qualifications to

teach DE courses. Educators should also consider creating a pathway for those teachers who may be a few college credit hours shy from DE certification.

K-12 Schools and Postsecondary Institutions

Although there are sometimes substantial costs of administering DE, this study suggests it is vital to continue finding ways to reduce the costs of DE to students and especially to low-income students and their families because the investment may greatly help improve their likelihood to persist in college and graduate with a degree. Further efforts could explore creating stronger partnerships between high schools and four-year institutions to ease the transition of students to and through postsecondary education. Instead of promoting DE courses mostly with two-year colleges, secondary schools should consider partnerships with more four-year institutions to align better align DE courses and programs. Additionally, K-12 schools and postsecondary institutions should consider partnering with teacher education programs to get more students into the rural education pipeline.

Conclusion

Research Summary

The purpose of this study was to examine the extent of whether DE influences first- to third-year college persistence, controlling for gender, race/ethnicity, SES, and rurality. The first chapter of this study introduced the topic of research. Chapter two introduced the research question and hypothesis as well as the theoretical and conceptual framework for the study. This chapter also presented literature on rurality, the influence of families and schools on rural students, and previous studies of DE programs. Chapter three introduced the methodology used to address the research question. An analysis of

HSLS:09 secondary data was the research method and variables were selected from different data collections. After missing data were removed and variables were coded, a binary logistic regression was conducted to test the hypothesis, while controlling for demographic variables. Chapter four presented the results of this regression analysis. The results revealed that high school DE courses are a significant predictor in student first- to third-year college persistence at four-year institutions.

Significance of Study Findings

While many of the problems rural schools face are connected to larger problems of population declines and lack of economic development, the results from this study are significant because they indicate that DE courses and programs hold promise for rural student college persistence and degree completion. With few studies that use national data to analyze DE and college persistence at four-year institutions and particularly for rural students, this research is a small addition to the literature by shedding further light on the relationship of DE and college student persistence. This study found that students who take high school DE courses are more likely to graduate from a four-year college or university, controlling for gender, race/ethnicity, SES, and rurality as compared to students who do not participate in DE. This study also found that Asian students had the greatest likelihood to persist from the first- to the third-year of college as compared with other races of DE students. However, Black/African American students had a slightly higher likelihood of persisting than Hispanic or more than one race DE students. Nevertheless, Hispanic students had the greatest influence on the relationship of DE to college persistence as compared to other races. Students who participated in DE courses in towns and rural areas were less likely to persist in college from first- to the third-year

as compared to those participating in a city or suburb. More surprisingly, low-SES DE students had the greatest likelihood to persist from the first- to the third-year of college as compared to other DE students as categorized by gender, race/ethnicity, SES, and rurality. With the limited research on the outcomes of participating in DE courses for low-SES and underrepresented student populations, these findings were significant. They strongly suggest that regardless of the administrative or financial costs of implementing DE, continuing to expand DE options for students could provide an effective way to increase the persistence of students on their path to postsecondary degrees, particularly for rural and low-income students.

Recommendations for Future Research

Although this study indicates that completing DE courses leads to increased first- to third-year college persistence, a future study should consider comparing first- to second-year with first- to third-year persistence. Additional analysis could also focus on students who took DE STEM courses in high school, persisted in DE college majors, and then completed STEM degrees as the HSLS:09 data focuses on students who took STEM courses and declared STEM college majors. Also, another study could use primary data collected directly from students to provide more information on whether the students began the process of social and academic integration that leads to retention as suggested by Tinto (1997). A qualitative research study could add a richness to this quantitative study. Moreover, a study on DE degree completion could be extremely valuable once the 2025 HSLS:09 data becomes available. Further, there is limited research on DE participation about females and minorities. Even though there are more females participate in higher education than males, and also more minorities migrating to rural

areas, students who participate in DE courses are still mostly male and White. Recommendations for future research could include an analysis of the benefits and challenges of DE participation for females and minorities. While this study investigated differences among DE students who had three or more credit hours, future research could also how the number of DE credit hours correlates with GPAs, college persistence, and financial savings for taking DE courses. Researchers may also want to investigate the effectiveness of DE programs that are fully or partially online, given that during the 2019/20 and 2020/21 school years many dual, concurrent, and AP courses were delivered online because of school closures resulting from the coronavirus pandemic. In addition, many states may be considering making a shift to offering more courses online in the future, especially dual enrollment courses that would otherwise take place on a college campus. Lastly, colleges that operate in education deserts may provide a very limited range of academic programs for students. Further research is needed to examine how geography is linked to DE and academic offerings, financial resources, and postsecondary outcomes. As the number of students who participate in DE continues to grow, so should the research into the area to aid educators, policymakers, students, and their families as they make important decisions that could affect their postsecondary outcomes for years to come.

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APPENDIX A

A1: Model 1: Main Effects (DE Participation)

Block 1: Variables in the Equation

								95% C.I. for EXP (β)	
Step		β	S.E.	Wald	*df*	Sig	Exp(β)	Lower	Upper
1									
	DE Participation	.687	.004	33486.775	1	.000	1.988	1.973	2.002
	Constant	.498	.002	87708.519	1	.000	1.645		

A2: Model 1: Main Effects (Demographics)

Block 2: Variables in the Equation

								95% C.I. for EXP (β)	
Step 1		β	S.E.	Wald	*df*	Sig	Exp(β)	Lower	Upper
	DE Participation	.521	.004	17803.563	1	.000	1.683	1.670	1.696
	Female	.477	.003	22626.310	1	.000	1.611	1.601	1.621
	Asian	.968	.010	8672.090	1	.000	2.633	2.580	2.687
	Black/African American	-.347	.005	5305.083	1	.000	.707	.700	.714
	Hispanic	-.494	.004	13840.011	1	.000	.610	.605	.615
	More than One Race	-.566	.006	10148.198	1	.000	.568	.561	.574
	SES	-1.162	.005	59661.948	1	.000	.313	.310	.316
	Constant	.599	.003	50175.899	1	.000	1.821		

A3: Model 1: Main Effects (Rurality)

Block 3: Variables in the Equation

Step 1		β	S.E.	Wald	*df*	Sig	Exp(β)	95% C.I. for EXP (β) Lower	Upper
	DE Participation	.607	.004	23222.540	1	.000	1.834	1.820	1.849
	Female	.488	.003	23349.115	1	.000	1.628	1.618	1.639
	Asian	.805	.010	5969.689	1	.000	2.237	2.192	2.283
	Black/African American	-.402	.005	6959.787	1	.000	.669	.663	.675
	Hispanic	-.574	.004	17576.795	1	.000	.564	.559	.568
	More than One Race	-.631	.006	12312.296	1	.000	.532	.526	.538
	SES	-1.166	.005	59106.742	1	.000	.312	.309	.314
	City	.151	.004	1371.802	1	.000	1.163	1.154	1.172
	Suburb	.491	.004	13357.349	1	.000	1.635	1.621	1.648
	Town	-.289	.005	3090.178	1	.000	.749	.741	.756
	Constant	.467	.004	17594.599	1	.000	1.594		

A4: Model 1: Moderating Effects (DE Participation x Demographics)

Block 4: Variables in the Equation

Step 1		β	S.E.	Wald	*df*	Sig	Exp(β)	95% C.I. for EXP (β) Lower	Upper
	DE Participation	.338	.006	3453.521	1	.000	1.402	1.386	1.417
	Female	.450	.004	15655.717	1	.000	1.569	1.558	1.580
	Asian	.793	.011	4792.907	1	.000	2.209	2.160	2.260
	Black/African American	-.440	.005	7167.207	1	.000	.644	.637	.651
	Hispanic	-.686	.005	21345.748	1	.000	.504	.499	.508
	More than One Race	-.661	.006	11557.171	1	.000	.517	.510	.523
	SES	-1.339	.005	63497.098	1	.000	.262	.259	.265
	City	.157	.004	1455.205	1	.000	1.171	1.161	1.180
	Suburb	.472	.004	12207.441	1	.000	1.603	1.590	1.617
	Town	-.292	.005	3157.861	1	.000	.747	.739	.754
	DE x Female	.146	.008	339.795	1	.000	1.157	1.139	1.175
	DE x Asian	.079	.028	7.644	1	.006	1.082	1.023	1.144
	DE x Black/African American	.126	.014	75.488	1	.000	1.134	1.102	1.167
	DE x Hispanic	.547	.013	1785.163	1	.000	1.729	1.685	1.773
	DE x More than One Race	.151	.017	80.374	1	.000	1.163	1.125	1.202
	DE x SES	1.070	.015	5054.857	1	.000	2.915	2.830	3.002
	Constant	.545	.004	21600.117	1	.000	1.724		

A5: Model 1: Moderating Effects (DE Participation x Rurality)

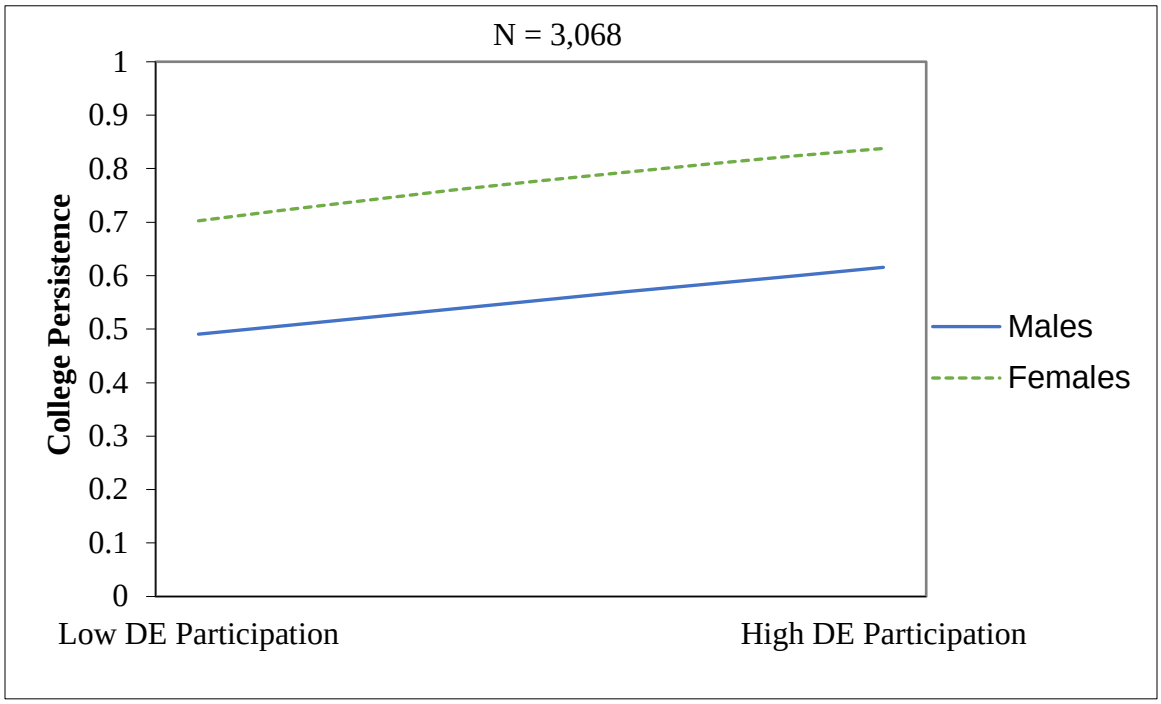
Block 5: Variables in the Equation

Step 1		β	S.E.	Wald	*df*	Sig	Exp(β)	95% C.I. for EXP (β) Lower	Upper
	DE Participation	.306	.008	1547.280	1	.000	1.358	1.337	1.379
	Female	.455	.004	15807.783	1	.000	1.576	1.565	1.587
	Asian	.741	.011	4162.787	1	.000	2.099	2.052	2.147
	Black/African American	-.458	.005	7673.345	1	.000	.632	.626	.639
	Hispanic	-.734	.005	23896.385	1	.000	.480	.475	.484
	More than One Race	-.692	.006	12557.365	1	.000	.500	.494	.506
	SES	-1.349	.005	63844.095	1	.000	.259	.257	.262
	City	.222	.005	2309.139	1	.000	1.248	1.237	1.259
	Suburb	.515	.005	11845.134	1	.000	1.673	1.657	1.688
	Town	-.589	.006	8351.218	1	.000	.555	.548	.562
	DE x Female	.122	.008	238.182	1	.000	1.130	1.113	1.148
	DE x Asian	.371	.029	168.118	1	.000	1.449	1.370	1.532
	DE x Black/African American	.384	.015	654.246	1	.000	1.469	1.426	1.512
	DE x Hispanic	.745	.013	3197.719	1	.000	2.107	2.053	2.162
	DE x More than One Race	.290	.017	297.266	1	.000	1.337	1.294	1.382
	DE x SES	1.053	.015	4888.476	1	.000	2.866	2.783	2.952
	DE x City	-.387	.010	1417.752	1	.000	.679	.666	.693
	DE x Suburb	-.297	.011	726.156	1	.000	.743	.727	.759
	DE x Town	.790	.012	4683.707	1	.000	2.203	2.154	2.254
	Constant	.559	.004	20355.903	1	.000	1.749		

APPENDIX B

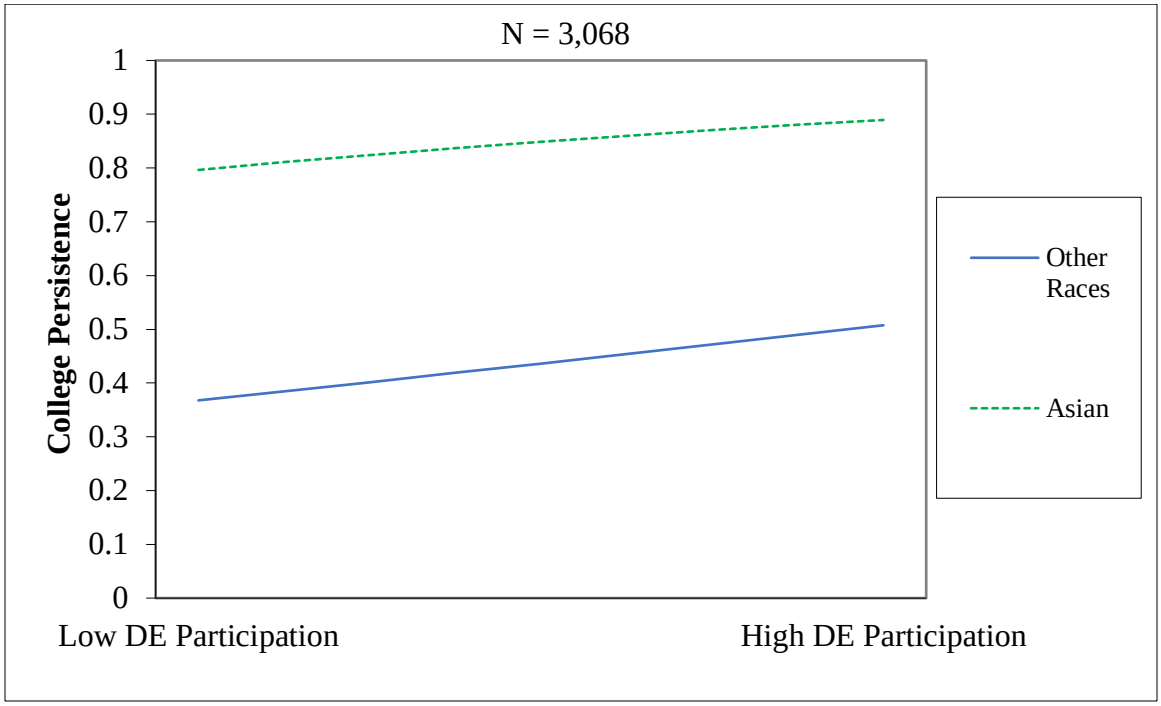
B1: Model 1: Main and Moderating Effects (Gender)

DE Participation and Gender



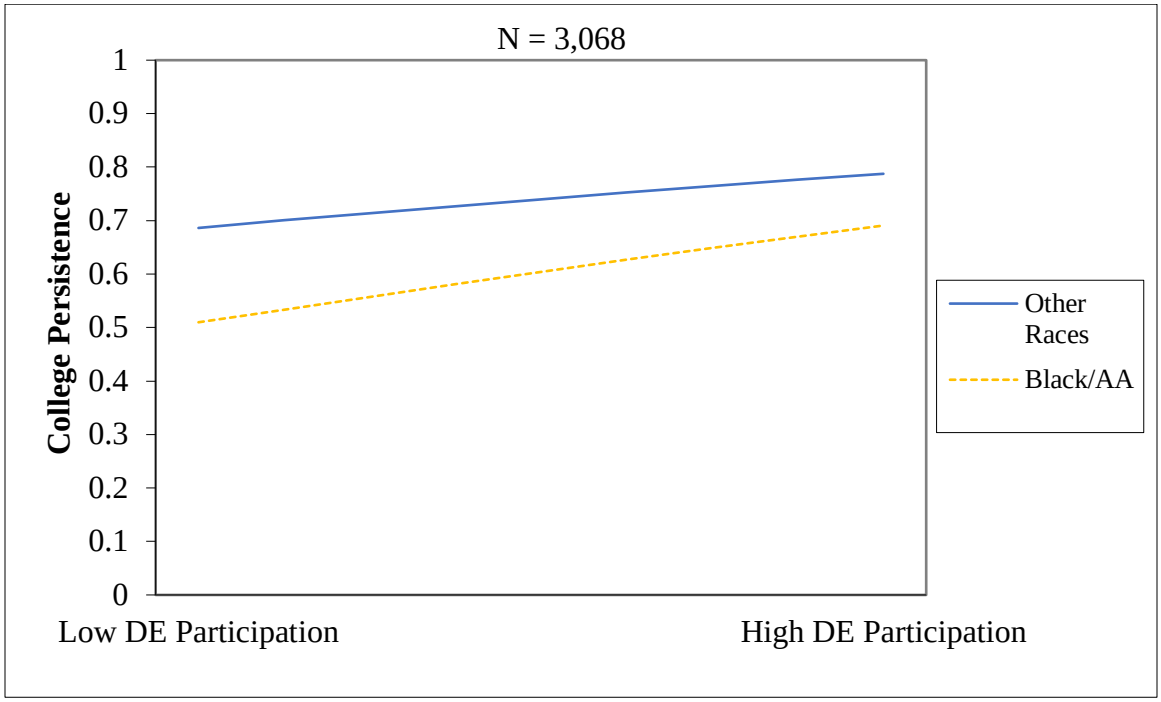
B2: Model 1: Main and Moderating Effects (Race/Ethnicity - Asian)

DE Participation and Asian



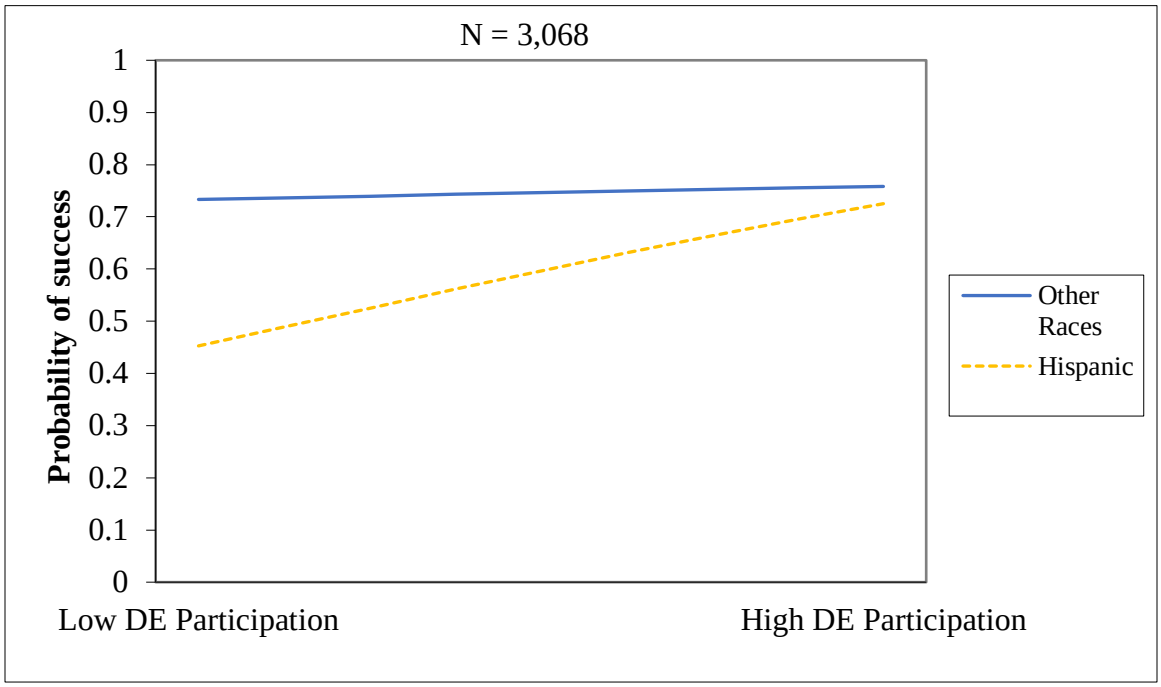
B3: Model 1: Main and Moderating Effects (Race/Ethnicity – Black/African American)

DE Participation and Black/African American



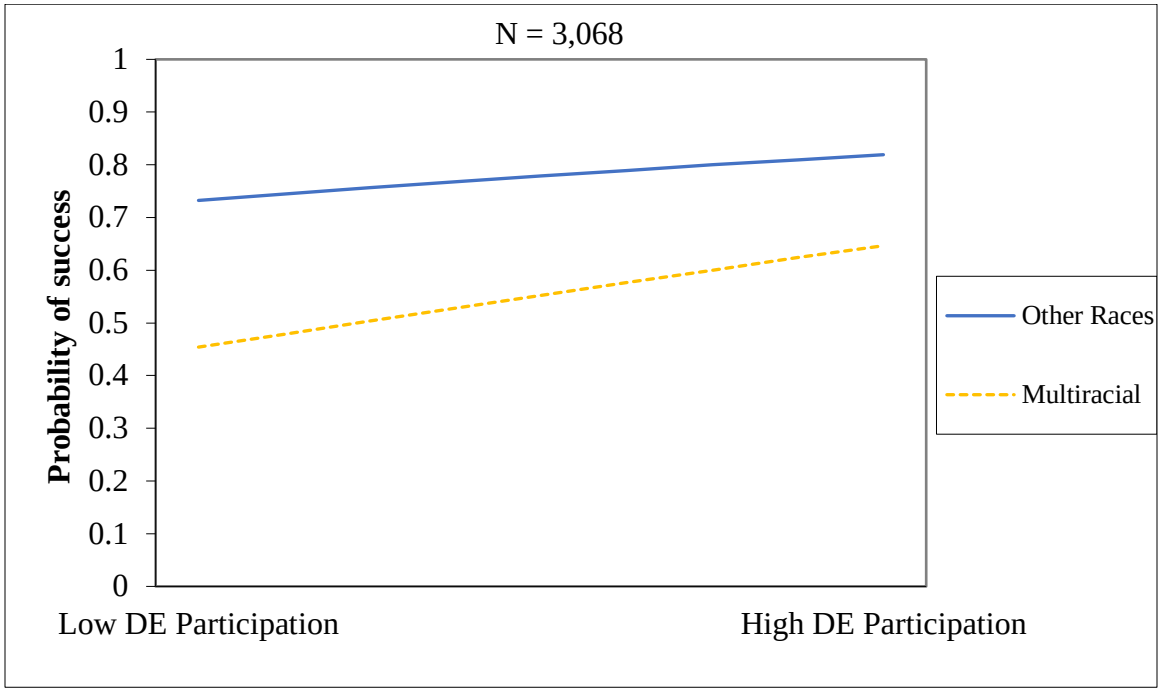
B4: Model 1: Main and Moderating Effects (Race/Ethnicity – Hispanic)

DE Participation and Hispanic



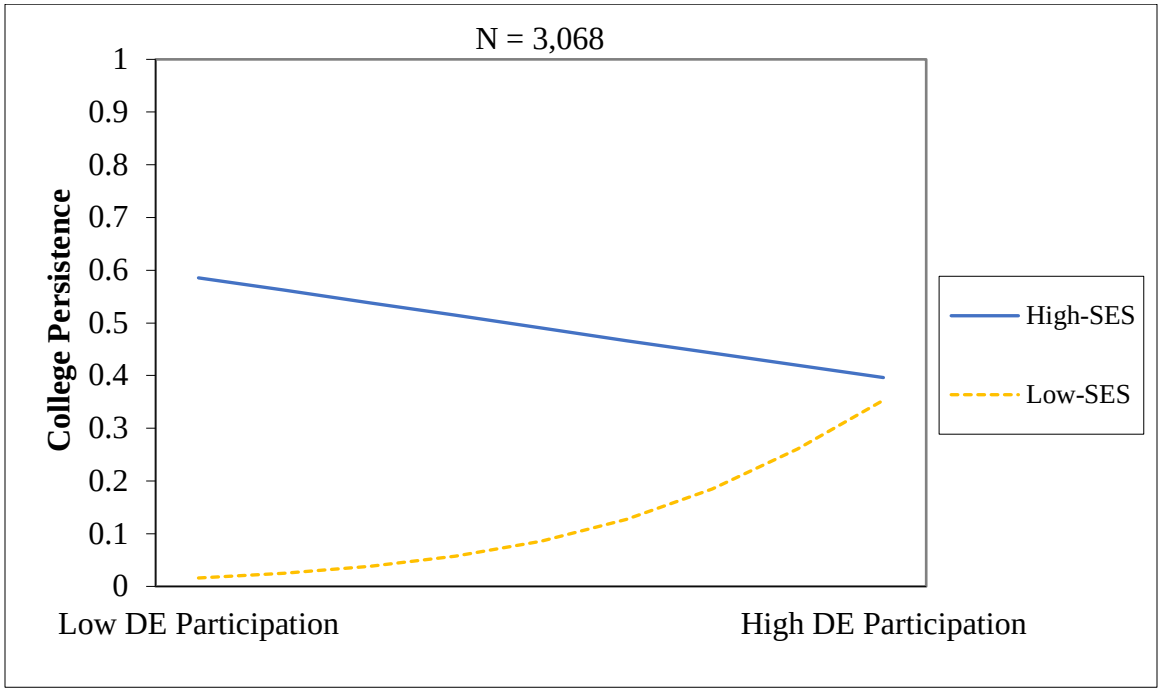
B5: Model 1: Main and Moderating Effects (Race/Ethnicity – More Than One Race)

DE Participation and More Than One Race



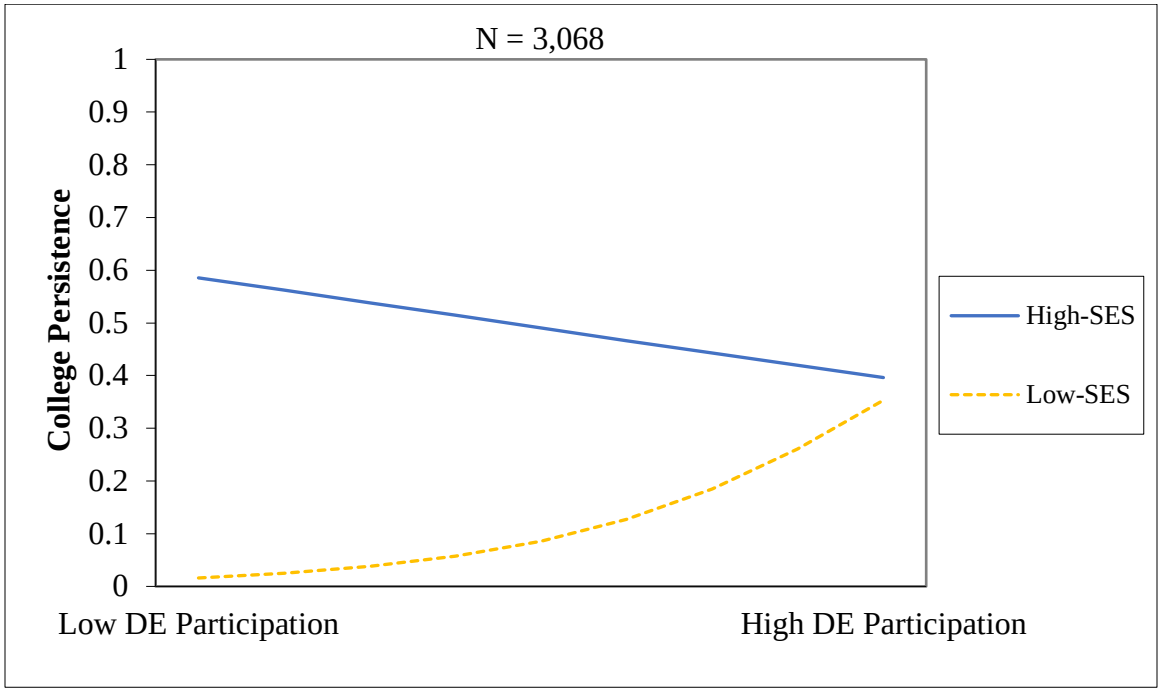
B6: Model 1: Main and Moderating Effects (SES)

DE Participation and SES



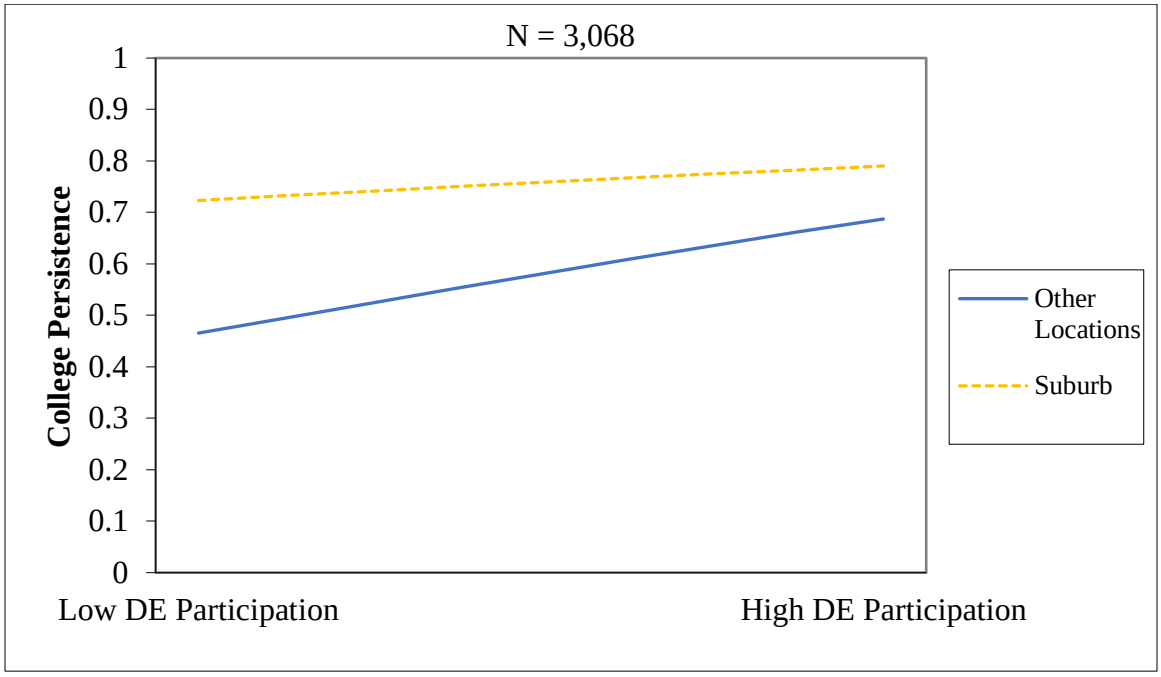
B7: Model 1: Main and Moderating Effects (City)

DE Participation and City



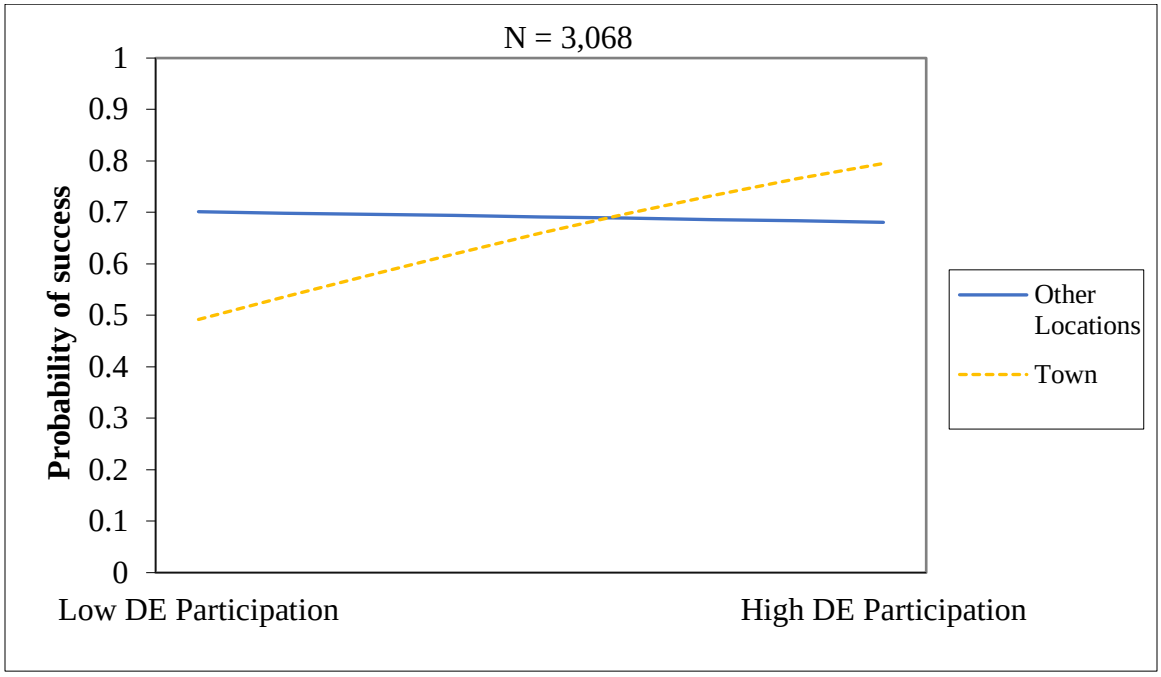
B8: Model 1: Main and Moderating Effects (Suburb)

DE Participation and Suburb



B9: Model 1: Main and Moderating Effects (Town)

DE Participation and Town



CURRICULUM VITA

NAME : Jeanne Guerrero

ADDRESS: P.O. Box 1703
Springfield, VA 22151

EDUCATION:

B.A., Journalism
Louisiana State University

Certificate of Latin American and Latino Studies
University of Louisville
Louisville, Kentucky

M.Ed., English Education
Delta State University

Ph.D., Higher Education Administration
University of Louisville

EXPERIENCE:

Equalyx Educational Consulting
Springfield, VA
2020 – Present
Education Consultant
Equalyx is an educational consulting firm that serves clients in K-12 and higher education. Equalyx combines primary research with advanced analytics and strategy consulting to help clients realize opportunities in sectors increasing growth potential and decreasing costs.

Hanover Research
Arlington, VA
2020
Content Director
Hanover Research is an education company that provides high-quality research and analytics to K-12 and post-secondary institutions. Responsibilities included:

- Developed, designed, and edited custom educational research projects using qualitative and quantitative methodologies for K-12 and postsecondary education clients.
- Supervised a team of content analysts, researchers, and sales associates.

The University of Louisville
Louisville, Kentucky
2009-2020
Program Director, High School Dual Credit/College Credit Programs, 2009-19
Director, Advanced Placement Summer Institute, 2010-19
The University of Louisville (UofL) is a public university located in Louisville, Kentucky. UofL has a total enrollment of approximately 22,000 with bachelor's, master's, and doctoral degrees. Responsibilities included:

- Directed student college credit programs, recruit part-time lecturers, coordinate school administrators, and coordinate pre-and post-program evaluation.
- Supervised dual credit education, English, and math coordinators, six UofL part-time lecturers, over 20 UofL certified high school instructors and four student assistants.
    - Increased dual-credit student enrollment by an average of six percent annually.
    - Generated revenues to the university's general operating funds of approximately $130,000 annually.
    - Gained university membership in the National Alliance of Concurrent Enrollment Partnerships (NACEP), the dual credit/enrollment accreditation agency, and worked to align programs with agency policies and procedures.
- Responded to grant opportunities for external funding of college awareness and transfer articulation improvements.
    - Secured over $300,000 in external grant and programmatic funding.
- Directed the annual College Board Advanced Placement Summer Institute (APSI) for high school teachers of advanced placement courses.
    - Wrote the proposal to create the APSI at the University. UofL became one of only two other universities to offer this institute in the state of Kentucky. Then asked to become director of the UofL APSI. Served as director from the program inception in the summer of 2001 until 2019.
    - Supervised College Board-certified APSI consultants, staff persons, and seasonal student workers.
    - Generated self-supporting programmatic funds of over $150,000 to $200,000 annually, which also contributed an

additional $30,000 - $40,000 in annual revenue to UofL operational funds from 2010-2019.
    - Hosted over 2,500 participants from 28 U.S. states and seven countries on the UofL campus from 2010-2019.
- Wrote proposal and directed College Board Advanced Placement Professional Development one-day fall workshop for high school teachers and program coordinators.

Interim Coordinator, International Student Undergraduate Admissions, 2013-2014
Appointed interim international student coordinator for undergraduate international student admissions in addition to responsibilities as program director of UofL High School Dual Credit/College Visitor Program and director of APSI. Responsibilities included:
- Streamlined admission guidelines by writing, updating, and recommending changes to admission criteria, policies, and procedures.
- Collaborated with other university departments to obtain applicant information to verify student data.
- Maintained database of UofL faculty-led and other departmental-sponsored international programs.
- Advised student centers and other departmental offices about UofL policies on student academic work and graduation from institutions worldwide.

Director of Technology/Community Development, 2002-2009
Appointed director of the UofL High School Dual Credit Program with a mandate to overhaul and expand participating schools and school district partnerships. Responsibilities included:
- Managed UofL part-time lecturers and worked with over 60 high school teachers and coordinators.
- Increased partnership schools from nine to 14. Also, increased class offerings from ten to 27 within two years.
- Managed a $220,000 yearly operational budget.

The Community @ eMain
Louisville, KY
Founding Executive Director, 2001-2002
Recruited to design, develop, and lead this educational technology institute located in the heart of downtown Louisville with the focus of creating educational programs for information technology professionals.
- Formed collaborative partnerships between the UofL, Jefferson County Public School Systems, Kentucky Community and Technical College System, and the City of Louisville to operate different classes and programs from the institute.

- Managed budget of over $1 million annually and supervised staff of two full-time workers.
- Louisville to operate different classes and programs from the institute.

The University of North Carolina, Greensboro
The SouthEastern Regional Vision for Education
Educational Technology Specialist, 1992-2001
SERVE is a federally funded resource center for K-12 teachers and administrators to assist in planning, implementing, evaluating, and improving programs and policies throughout the Southeastern United States and Puerto Rico. Responsibilities included:

- Developed district-wide educational technology plans that included training and support for K-12 and university teachers and administrators.
- Assisted administrators and staff to implement procedures trained and supervised training of school-based technology teams with regional institutions to create organizational alliances. The primary focus was to work intensively with K-12 schools and school districts to improve student-learning outcomes in Alabama, Arkansas, Mississippi, and Tennessee.
  - Developed multimedia video for the school that won the State Blue Ribbon award for Excellence at Booneville Middle School in Booneville, Mississippi.
  - Revised Comprehensive Outcome Evaluation for Central Middle School in Lake Village, Arkansas.
  - Wrote SERVE Guidebook for Using Electronic Portfolios in a School District.
  - Developed Delta Project Monograph to train math and science teachers using technology in collaboration with the National Aeronautics and Space Administration - Tri-State Education Initiative (NASA-TSEI).

HONORS AND AWARDS:

National Science Foundation Innovation Corps (I-Corps), spring 2018

- Nominated to participate in a program that prepares academics to move work toward commercialization. The proposal is currently being evaluated for a possible $50,000 in funding.

National Science Foundation-AWARE: ACCESS program, spring 2018

- Awarded $5,000 in Accelerating Women and Underrepresented Entrepreneurs: Accelerate Entrepreneurial Success (AWARE: ACCESS) program for training and support of innovative research.

University of Louisville National Science Foundation I-Corps Award, fall 2017

- Awarded $2,500 to develop an entrepreneurial project with commercial viability.

University of Louisville Publishing Academy Participant, spring 2016

- Selected as a participant in the first UofL Publishing Academy cohort for graduate students.

Association of College Unions International (ACUI), December 2015

- Received leadership award from the UofL Commission on the Status of Women (COSW) to attend the conference.

GRANTS:

Principal Writer, The Fourth Friday Transfer Student Tour, funded by the Council on Postsecondary Education, ($8,186 for one year) 2010.

Principal Writer, Kentucky Adult Learner Initiative: Lessons Learned, Council on Postsecondary Education, funded by the Council on Postsecondary Education, ($20,000 for one year) 2009.

Principal Writer, the University of Louisville Advanced Placement Summer Institute, approved site granted by the College Board; initially funded by the University of Louisville ($150,000 start-up funds) 2009. Institute now generates self-supporting funds.

Principal Writer, Kentucky Adult Learner Initiative: University of Louisville Institutional Plan, funded by the Council on Postsecondary Education ($30,000 for two years) 2009.

Principal Writer, Think College Now, funded by the Council on Postsecondary Education ($8,075 for one year) 2009.

PUBLICATIONS:

Guerrero, J., "Real Women Have Curves." *Raído,* v. 6, n. 12: 85-94, July, 2012.

SELECTED PRESENTATIONS:

Guerrero, J. (2017, March). *The Potential for Educational Technology to Bridge Precollege Science, Math, and Technology Education for Hispanic and Latino Students*. Presented at the International Technology and Education Conference (INTED), Valencia, Spain.

Guerrero, J. (2017, October). *Dual Enrollment Equity, Accessibility, and Affordability for Latino Students*. Presented at the National Alliance for Concurrent Enrollment Partnerships (NACEP) annual conference, Washington, D.C.

Guerrero, J. (2016, October). *Dual Credit and Central High School: Advancing Minority Student Opportunities*. Presented at the National Alliance for Concurrent Enrollment Partnerships (NACEP) annual conference, Louisville, Kentucky.

Guerrero, J. (2013, February). Racism, Colonialism, and the Mexican American: Recurring Themes of Struggle in the novel, *Y no se lo tragó la tierra***.** Paper presented at the Louisville Conference on Literature and Culture, Louisville, KY.

Guerrero, J. (1999, June). *Managing One or More Computers in Your Classroom While Keeping Your Hair and Your Sanity*. Presented at the National Educational Computing (NECC) Conference.

Guerrero, J. (1999, February). *Is the Stress from New Technology Getting to You? How to Manage One of More Computers in Your Classroom*. Presented at the Mississippi Educational Computing Association (MECA) Conference.

COMMITTEES

The University of Louisville
Commission on the Status of Women
Chairperson, 2015-18
Vice Chair, 2018-16
Member, 2009-18

The University of Louisville
Hispanic and Latino Faculty and Staff Association
Treasurer, 2015-18

National Alliance of Concurrent Enrollment Partnerships (NACEP)
Research Committee Member, 2018-2019
University Representative, 2016-2019

COMMUNITY ACTIVITIES:

Adelante Hispanic Achievers
Board of Directors, 2018 - 19
Intern and Volunteer, 2013 – 2018

Greater Louisville Workforce Education Initiative
Board Member, 2009

Jefferson County Public Schools Adult Education Program
Board of Advisors, 2002-2004

AmeriCorps National Service
Member, 1992, 1993