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2018

Student attributes related to dual enrollment baccalaureate degree outcomes in a rural state

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**STUDENT ATTRIBUTES RELATED TO DUAL ENROLLMENT BACCALAUREATE
DEGREE OUTCOMES IN A RURAL STATE**

SIGNATURE PAGE

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Project Title: Student Attributes Related to Dual Enrollment Baccalaureate Degree Outcomes in a Rural State

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04/02/2018	Date

ACKNOWLEDGMENTS

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ABSTRACT

A decrease in West Virginia in-state college-going and graduation rates and a need for additional postsecondary degrees in the workforce in the state by 2020 require the support and implementation of an evidence-based intervention to ameliorate the pressing issue. This study considers the outcomes in regard to persistence and completion of West Virginia students enrolled in public baccalaureate degree granting institutions in the state who entered as first-time, full-time freshmen during the 2010 academic year with dual enrollment credit. The population of the study was drawn from preexisting data provided by the West Virginia Higher Education Policy Commission. Propensity score matching and statistical analyses, including chi-square, t-test, and logistic regression were used to address the research questions. The study's findings indicate a significant relationship between dual enrollment and persistence, and also with graduation. These findings also support that among socioeconomic status, college readiness, rurality, sex, and minority status, dual enrollment presents significant models in both persistence and graduation. At the variable level, however, neither sex nor minority status were found significant for persistence or graduation. Further analysis determined that dual enrollment increased the average number of credits earned by the second fall semester by one three-credit course on average and further determined that the dual enrollment students were more likely to graduate based on the number of credits accumulated that same semester.

CHAPTER 1

INTRODUCTION TO THE PROBLEM

Dual enrollment courses are well-recognized for their success in providing advanced high school curriculum and accelerating postsecondary degree completion. Dual enrollment is a collaborative effort between a postsecondary system or institution and high schools where students earn college credit while still attending secondary institutions. In addition to the contribution of high school rigor, studies have shown that there is merit to both the accumulation of credits received prior to college matriculation and the number of credits earned by the completion of the first-freshman year in degree completion (An, 2013). This study considers the outcomes in regard to persistence and completion of West Virginia students enrolled in public baccalaureate degree granting institutions in the state who entered as first-time, full-time freshmen during the 2010 academic year with dual enrollment credits.

An historical perspective underscores the need for the proposed study. West Virginia implemented a statewide dual enrollment initiative in 1997. According to a ten-year benchmark study conducted by the West Virginia Higher Education Policy Commission and the West Virginia Council for Community and Technical College Education (HEPC & CTC), students in the 2003 fall freshmen cohort group attending a West Virginia public college or university who possessed dual enrollment credit earned a grade point average (GPA) of 2.78 in the fall of 2004, with an increase to 2.95 the following spring semester (HEPC & CTC, 2005). Aside from the HEPC/CTC analysis, data is lacking on the overall success of West Virginia's dual enrollment program. In light of the support for dual enrollment credit in relation to enrollment and completion (Howley, Howley, Howley, & Duncan, 2013), it is important to review the influence of these credits on West Virginia students for policy implications on the twenty-year-old

program (HEPC & CTC, 2005). It is especially important to examine characteristics that may influence enrollment and completion, including socioeconomic status (An, 2013), rurality (Byun, Irvin, & Meece, 2012), sex (Diprete & Buchmann, 2006), race (Carol, 1989), readiness, and confounding characteristics (An, 2013) and how they relate to the effectiveness of dual enrollment credit for enrollment and completion in West Virginia.

According to the *West Virginia Higher Education Report Card, 2016* (HEPC & CTC, 2017) , a yearly report that provides data from all West Virginia public education institutions, there were more than 18,000 college degrees awarded by West Virginia public colleges and universities in 2014 and 2015. According to the West Virginia Center on Budget and Policy (2013), using 2011 census data it was determined that 39.4% of West Virginia workers require better skills and wages citing a need for stronger educational pathways. Of those 263,531 workers, 27.8% have some college education and 15% are without a high school diploma. The Center continues to note that West Virginia is 13th highest in the nation for the need for better skills and wages (West Virginia Center on Budget and Policy [Center], 2013). To address the shortfall, the HEPC and CTC launched a *Double the Degrees* initiative in 2017 in recognition that by the year 2020 over half the state's available jobs will require an associate's degree or higher (HEPC & CTC, 2017). Today, only 29.9% of residents fall into that category (HEPC & CTC, 2017). Further, according to a report by the College in High School Alliance, 65% of jobs in the United States will require a postsecondary degree by 2020 (College in High School Alliance, 2017). The Alliance report also provides dismal information in regard to growth over the previous academic year: a 0.1% increase in college going rates and also an increase of 1.1% in degrees awarded by public colleges and universities.

Enrollment and graduation rates for at-risk students are particularly troublesome. The

percentage of change for low-income students in West Virginia public postsecondary schools in the 2015-2016 academic year when compared with the previous year decreased 5.3%. During the same period, there was a 9.8% drop in undergraduate adults, but a positive note is a 2.2% increase for underrepresented minorities. Concurrently, dual enrollment of high schools students in public four-year colleges and universities increased 40.3% from 2014, 2,455 students, to 2015, 3,445 students (HEPC & CTC, 2017).

Support for dual enrollment programs is indicated in a *What Works Clearinghouse* report published by the U.S. Department of Education, Institute of Education and Sciences (2017). The report notes that dual enrollment programs support college credit accumulation and degree attainment through three mechanisms: (1) experience garnered by the student; (2) credit accumulation; and (3) an overall reduction in cost-of-degree. The report further indicates that there is sufficient evidence to introduce dual enrollment programs as an evidence-based intervention for degree attainment, college access and enrollment, among other positive outcomes.

Dual enrollment courses are offered at a lower cost and they are a more secure alternative, i.e. no standardized test requirement, when considering other early credit options such as advanced placement credit and CLEP testing. According to Series 19 (2016), postsecondary institutions are required to charge at least $25.00 per credit hour as special tuition for high school students. This special rate is cheaper than the costs associated with traditional college courses. As an example, the average cost for in-state postsecondary students in West Virginia for tuition was $7,490 for the 2016-2017 academic year (College Board, 2017d). This equates to around $219 per credit hour if one assumes two 15-hour semesters over this period. Further, the $75 fee for a three-hour dual enrollment course is equivalent to the costs of CLEP

testing, $80.00 per test in 2017 (College Board, 2017b) and AP exams $93 (College Board, 2017c). In addition to cost, dual enrollment courses do not require standardized testing as with CLEP or Advanced Placement (AP) credits, which may deter students from assuming the risk of producing an inadequate score.

In light of the articulated need for more postsecondary graduates and the paucity of West Virginia's dual enrollment data analysis, the findings of this study may lend support for a more robust dual enrollment program in the state. A strong dual enrollment program can potentially assist with meeting the 2018 Master Plan goals established for increased access and success for West Virginia students (HEPC, n.d.a), to *Double the Degrees* in the state (HEPC & CTC, 2017), and to inform public policy. The findings may also promote additional collaboration between the WVHEPC and the West Virginia Board of Education, thereby streamlining the dual enrollment program in the state.

PROBLEM STATEMENT

A decrease in West Virginia in-state college-going and graduation rates and a need for additional postsecondary degrees in the workforce in the state by 2020 require the support and implementation of an evidence-based intervention to ameliorate the pressing issue. Additional research is necessary to determine if dual enrollment programs are beneficial to the West Virginia public postsecondary system and underrepresented students as suggested through similar research.

PROBLEM BACKGROUND

As mentioned, dual enrollment credit programs are purported as an evidence-based intervention showing positive effects on student degree attainment, college access and enrollment, credit accumulation, high school completion , and general academic achievement

students by the Institute of Education Sciences (2017), an office of the U.S. Department of Education. It is noted, however, that two of the major studies used in this systematic review undertaken by the Office to determine effectiveness used the Early College High School Model as opposed to a dual enrollment model similar to West Virginia (Berger, Garet, Hoshen, Knudson, & Turk-Bicakci, 2014; Edmunds, et al., 2015). These early colleges models were developed by the Bill and Melinda Gates Foundation, and in similar fashion to the West Virginia dual enrollment program, they are designed to provide access to college courses in high school (Berger, et al., 2014). Since the inception of the early colleges, more than 240 have opened but they differ in that they provide an associate's degree or up to two years of credit in collaboration with postsecondary institutions. Further, these programs are targeted toward underserved students. It is, therefore, important to note that the student population and organization of these programs vary from the West Virginia dual enrollment model. The Institute's study also takes into consideration three other studies based on the dual enrollment model (An, 2013; Giani, Alexander, & Reyes, 2014; Struhl & Vargas, 2012). Of these studies, An (2013) is most relevant as it has a national focus with a larger population, while the other two focus solely on Texas systems (Institute of Education Science, 2017).

     An's study is of interest as it indicates that dual enrollment had a positive effect on degree attainment for low-income students and it further provides rationale for the mathematical tests used for this research (2013). However, An used the most current National Education Longitudinal Study data (n=8,800), from 1988 base year with follow-up administration in 1990, 1992, 1994, and 2000. These data do not represent a contemporary view of dual enrollment credits. Swanson (2008) used the same dataset but applied regression equations to measure dual enrollment with demographic background, high school history, college factors, and

persistence/credit accumulation. Significant findings supported dual enrollment in regard to postsecondary enrollment, persistence through the second year of college, likelihood of earning a degree, and educational expectations. Demographic descriptors used in the study failed to present significant statistical results.

PURPOSE

The purpose of this study was to evaluate the effectiveness of dual enrollment in West Virginia in order to inform educational strategy and policy development. By determining effectiveness of dual enrollment programs in the state, policymakers and educators alike will gain a better understanding of the program's influence on not only the public student population as a whole, but also in considering vulnerable populations less likely to enroll or complete postsecondary baccalaureate education.

The data available in regard to the effectiveness of dual enrollment credits are limited at both national and state levels. Dual enrollment programs vary across states and contribute to this limitation (Allen, 2010). However, it is important to determine the influence, if any, that dual enrollment credits have on enrollment and graduation of public West Virginia students in baccalaureate institutions. It is also crucial that vulnerable populations are considered in order to determine program effectiveness for underrepresented students who often struggle with postsecondary access and completion. Engle and Tinto (2008) indicate that low socioeconomic status (SES) first generation students are more likely to drop out within the first two years of postsecondary schooling. Also, in comparison to other students, those from low SES backgrounds are less likely to earn a degree from baccalaureate institutions (Titus, 2006). Results will apprise policymakers and institutions on whether investment in dual enrollment credits can

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assist in meeting enrollment and completion goals in order to meet West Virginia workforce needs.

ASSUMPTIONS

The data used in this study were generated through the submission of student level information to the HEPC by public postsecondary institutions in the state. Although variable criterion is specified through the provision of coding instructions for the various reports uploaded by the institutions, there is a possibility of coding error. Each institution has different procedures, offices, and positions responsible for the collection, entry, and provision of information uploaded to the HEPC; therefore, reliability of the data could be compromised due to interrater and data entry inconsistency. The HEPC takes proactive measures to reduce the occurrence of these concerns aligned with using preexisting data.

SCOPE AND DELIMITATIONS

The population of this study is derived from data collected by the West Virginia Higher Education Policy Commission (HEPC) in a six-year period from 2010 to 2016. These years were chosen as it provides the most current data available for six consecutive years. The data are inclusive of all students enrolled in West Virginia public postsecondary students and the sample used in this research is derived from multiple data files of these students and organized based on specific purposes, i.e. enrollment, financial aid, etc. Dual enrollment is recorded at the institution at the time the high school student enrolls in a college course; therefore 2007 through 2009 dual enrollment data was used in order to designate dual enrollment students who started as first-time full-time freshmen in West Virginia public baccalaureate degree granting institutions in the 2010 academic year. The data are collected by public postsecondary institutions in West Virginia and are submitted as applicant, course, registration, graduation, and student files through the HEPC

data submission portal. The reports are submitted throughout the year depending on report type. The participating schools relevant to this study are Bluefield State College, Concord University, Fairmont State University, Glenville State College, Marshall University, Potomac State College of West Virginia University, Shepherd University, West Liberty University, West Virginia State University, West Virginia University, and West Virginia University Institute of Technology. Public two-year and private institutions are excluded from the sample.

LIMITATIONS

As the data does not capture all postsecondary students in West Virginia, the sample is limited to only those students who enrolled in the institutions listed above during the designated period. An additional consideration in regard to the students labeled as taking dual enrollment courses prior to matriculation is that the student would need to have taken the coursework through a West Virginia public institution during the period between the 2007 to 2009 academic years. Designation of dual enrollment as opposed to another mechanism to obtain college credit is dependent on the ability to verify that a student is dually enrolled as type of registration in the HEPC student and course file datasets. If a student took the dual enrollment course from a different state, the student would then be designated as earning college hours in high school which would include advanced placement credit, not dual enrollment.

The data from this study are limited in terms of generalizability to West Virginia public postsecondary students. Due to the geographical limitation of including only West Virginia, readers should use caution when extrapolating findings to other populations such as Virginia, Kentucky, or Ohio. Also, postsecondary students who are enrolled in private institutions are excluded from this study. Institution type should also be considered in regard to generalizability of findings from the study. State level data are used as opposed to national data due to the

inconsistency of the designation of what constitutes dual enrollment from state to state. It further influences outcome measures as students who begin as part of the sample transfer out of West Virginia, and/or to a private institutions, and graduate are not captured as successful completers. In addition to data considerations in regard to limitations, areas for future consideration are not explored in this study. Also, only dual enrollment information provided by public baccalaureate degree granting institutions in West Virginia are used for this research. Any data collected by high schools or county boards of education are not included in this study which should avoid any duplication in the data set. These separate means of collection have derived some criticism that schools are double counting dual enrollment students for additional financial support (D. M. Anderson Ed.D., personal communication, Aug. 22, 2017). AP courses, CLEP, and the Early College High School Model will not be explored in this study, as well as, other institutional and student financial considerations regarding dual enrollment programs.

NATURE OF THE STUDY

This research is longitudinal, inferential, and uses a quantitative research design. Inferential studies judge the probability that an observed difference did not happen by chance, while descriptive studies require the absence of manipulation of the environment (Nebeker et al, 2015). As existing data provided by the HEPC is used, no experimentation will occur. Further, the study follows the 2010 first-time, full-time college freshman cohort through a period of six-years, making it longitudinal. In using a six-year timeframe, the freshman cohort is tracked for the industry-accepted graduation rate standard as determined by the National Center for Education Statistics (NCES) for IPEDS reporting (United Stated Department of Education National Center for Education Statistics [NCES], n.d.). Quantitative design for the West Virginia

public postsecondary population allows data analysis using statistical measures to answer the research questions.

Propensity score matching techniques along with statistical testing is used to determine the effectiveness of dual enrollment courses. Student factors including sex, college readiness as assessed through grade point average, socioeconomic status (SES) determined by family income, rurality, and minority status, evaluated through conducting regression analysis. These statistical approaches are in line with the methods utilized by An in his 2013 study involving the effect of dual enrollment credits on low-SES student degree attainment. The quantitative design is efficient, unrestrictive in regard to cost, and provides generalizability for West Virginia public postsecondary students. Although a qualitative analysis would provide rich detail regarding dual enrollment students, the current design is in line with existing studies and is better attuned to the research questions posed in this study for the above mentioned details and aim.

DEFINITION OF TERMS

Dual enrollment credit is defined as observed by Series 19 (2016), "[c]ollege credit opportunities which will be counted as credit hours attempted and/or earned for early enrollment reporting purposes are those course sections that are delivered primarily to eligible high school students." For the purposes of this study, only those courses offered by public postsecondary institutions were counted.

Rurality is defined by the United States Department of Agriculture's Economic Research Service (ERS) through the designation of nonmetro or metro counties. This classification uses the 2013 Rural-Urban Continuum Codes which "distinguishes metropolitan counties by the population size of their metro area, and nonmetropolitan counties by degree of urbanization and

adjacency to a metro area" (United States Department of Agriculture, Economic Research Service, 2016, para. 1).

Socioeconomic status is determined by Pell Grant eligibility in the freshman year due to the limitation of duration. According to Federal Student Aid, an office of the Department of Education, (n.d.), Pell Grant eligibility is determined by financial need (i.e. an Expected Family Contribution, or EFC, of $4,617 or lower as determined by the FAFSA for the 2016-17 academic year) (pellgranteligibility.org, n.d.).

College readiness is determined by high school grade point average as opposed to an SAT score of 480 in evidence-based reading and writing, and a 530 in math (College Board, 2017a). For the ACT, a score of 18 is needed in English, 22 in Mathematics, 22 in Reading, and 23 in Science (ACT, 2017). Although standardized scores are commonly used, high school grade point average shows promise as a more effective indicator of college access and completion (Hiss & Franks, 2014).

Persistence is defined as returning in the second Fall semester, i.e. enrolling in the semester one-year following the initial enrollment. According to the National Student Clearinghouse Research Center (2017), persistence rates are calculated using the percentage of students returning to any institution for their second year.

RESEARCH QUESTIONS

1. There is a significant effect on persistence and graduation in West Virginia public baccalaureate postsecondary schools from students who complete dual credit courses.
2. There is a significant effect on the persistence and graduation of dual credit students in West Virginia public baccalaureate postsecondary schools based on the following student characteristics as evaluated as dichotomous variables: socioeconomic status (Pell eligible, not

eligible); sex (male, female); college readiness (high school grade point average), rurality (West Virginia metro county, West Virginia nonmetro county), and minority status (White, other race/ethnicity).

SIGNIFICANCE OF THE STUDY

To meet the growing need for an educated workforce, West Virginia must find cost-effective ways to increase the college-going rate and shorten time to degree completion. An evidence-based intervention is necessary in order to move the state forward. Although baccalaureate college graduation rates have shown an increase in both the four and six year rates (HEPC & CTC, 2015), the overall need for an educated workforce remains unmet. According to Bashir, Herath, and Gebremedhin (2013), education and economic growth positively effect each other; the same stands true for West Virginia. Bashir and colleagues further extol the importance of comprehensive policies to enhance economic growth and educational improvement due to low educational attainment and high unemployment rates.

As noted, the number of West Virginia students enrolled in dual enrollment courses at four year public institutions increased 53.7% from 2011, 2,241 students to 2015, 3,445 students (HEPC & CTC, 2017). Missing is an essential in-depth analysis to determine dual enrollments' effectiveness for increasing postsecondary persistence and completion, along with an understanding of key characteristics. The work of Adelman (2004), Swanson (2008), An (2013), and a Department of Education systemic review (2017) support dual enrollment on a national context, but these studies do not account for West Virginia's unique characteristics. This study seeks to address the need for additional dual enrollment effectiveness data in West Virginia as well as provide additional insight into the influence of certain characteristics on enrollment and completion in order to address vulnerabilities associated with low postsecondary achievement.

SUMMARY

Dual enrollment opportunity has shown positive outcomes in regard to postsecondary enrollment and completion. While no data exists in regard to the effectiveness of the dual enrollment programs in West Virginia, there is an expressed need to improve the persistence and completion of public postsecondary students in the state. This study seeks to remediate the absence of data in order to support the *Double the Degree* initiative set forth by the West Virginia Higher Education Policy Commission, to meet the need for an educated workforce, and to improve the likelihood of completion of low performing/vulnerable postsecondary students in the state. Data exists in regard to effectiveness of dual credit programs in achieving these outcomes nationally and in other states, but generalizability of these findings to West Virginia is ineffective due to the population's characteristics. This study was designed with consideration of these characteristics and the expressed need, while being grounded through the methods and findings from relevant existing research.

CHAPTER 2

REVIEW OF THE LITERATURE

This review of the literature provides a thorough overview of the information available regarding dual enrollment programs, including the definition of dual enrollment; an outline of the research regarding secondary and postsecondary characteristics affecting postsecondary attainment; and findings on dual enrollment's effectiveness in regard to postsecondary enrollment, retention, and graduation at national and state levels. The literature available is limited not only for the state of West Virginia, but also nationally, in part, due to a lack in uniformity of dual enrollment programs across the country.

In 2017, the U.S. Department of Education Institute of Education Sciences published a *What Works Clearinghouse* (WWC) report designed to provide a systematic review of dual enrollment programs and the evidence available on the programs' effectiveness. From this review, the Institute identified 35 studies specifically relating to dual enrollment for high school students. Only two studies – Berger, Turk-Bicakci, Garet, Knudson, and Hoshen (2014), and Edmunds et al. (2015) – met *WWC* design standards without reservation. These studies used Early College in High School (ECHS) students who were enrolled using randomized control sampling. Although these studies are held in high regard for their quality of design, the ECHS population does not directly compare to traditional dual enrollment programs, as ECHS schools are comprehensively designed around college readiness (Edmunds et al., 2015). This immersive and comprehensive design is a significant departure from traditional dual enrollment programs such as those seen in West Virginia. The report further cites three other studies that met review criteria with reservations. Of these studies, two used only Texas students, while the third used

National Education Longitudinal Study data. An (2013), is discussed in detail below for this reason.

As evidenced by the 2017 Department of Education systematic review, the studies available are limited in regard to quality, program type – traditional dual enrollment versus ECHS – and population characteristics. In fact, only a few published studies using national data are available including An (2013), Adelman (2004), and Swanson (2008). All three studies rely on the NELS 1988/2000 longitudinal dataset. Of closest merit in regard to this proposed research is An (2013) for data analysis and Adelman 2004 study as the data are separated into attributes similar to those proposed here. It is important to note that these studies used the most recent data available at the national level as it provided the variable specificity required to differentiate type of postsecondary acceleration credits received in high school. Therefore, it is essential to consider the availability of contemporary data possessing the depth of data required in order to address the research question(s). It is further just as important to understand the WWC process.

The *What Works Clearinghouse (WWC)* is a U.S. Department of Education initiative designed to assist educators in making evidence-based decisions through the provision of high quality systematic reviews of available research (U.S. Department of Education, Institute of Education Sciences, n.d.). The clearinghouse trains certified reviewers whose responsibility is to "assess the strength of evidence provided by individual studies" (U.S. Department of Education, Institute of Education Sciences, n.d, p. 1). According to the Clearinghouse, the reviewers first identify the studies relevant to the issue and then assess them to determine their quality and eligibility for inclusion. Quality is determined by several factors relating to the study's design and the outcome rating is provided based on these elements. There are three ratings provided by the Clearinghouse: the highest is "meets WWC design standards without reservation," which

indicates that the "highest degree of confidence that the intervention caused the observed effect" (U.S. Department of Education, Institute of Education Sciences, n.d, p. 2). The others in order of quality are "meets with reservations" and "does not meet design standards." It is important to note that these criterion are based on ideal empirically designed studies with the presence of a randomly assigned control being the highest. Although this type of research design is best at determining causation, one should use caution when throwing out findings from other lesser ranked studies. Studies using randomized samples with control groups are often difficult or undesirable to conduct in educational settings, but can still yield meaningful findings.

Dual Enrollment Defined

Dual enrollment programs are essentially a collaborative effort between a postsecondary system, or institution, and high schools where students may obtain college credit in various ways (Allen, 2010). A wide array of dual enrollment programs exist throughout the United States and their makeup varies dependent not only by state, but can also differ by the postsecondary institution sponsoring the program. The programs may entail the student attending classes on a college campus, or in their own high school. They might also provide high school credits toward graduation, or not. As opposed to advanced placement (AP) courses, these college courses do not target only above average students, nor do they require an exam in order to receive credit (Allen, 2010). Dual enrollment courses are provided by a postsecondary institution through the provision of college level material by an instructor meeting the requirements to teach at the postsecondary level.

There are several variations of dual enrollment design and dual credit provision including traditional dual enrollment as discussed above, ECHS programs, and Advanced Placement (AP) and College Level Examination Programs (CLEP). This study utilized the West Virginia dual

credit course determination that applicable courses are taught for both college and high school credit, and meet the course content standards and objectives as required by the West Virginia Board of Education Policy 2510 (2016) and W. Va. §18B-133-19 (Series 19, 2016). These provisions are minimal standards that provide significant autonomy to county boards, postsecondary institutions, and high schools.

West Virginia Board of Education Policy 2510. According to West Virginia Board of Education Policy 2510, a dual credit course "must meet both specified course content standards for secondary offerings and the college course requirements" (2016, p.40), as well as provide both high school and college credit. It further requires that county boards of education maintain policy for the attainment of college credit and that they meet state board approved county and policy documentation. Based on these two specific inclusions in policy at the state level, each county determines what the requirements are in regard to the provision of dual enrollment courses and the type of credit they may or may not carry. As an example, a course could be offered as dual enrollment without meeting the requirements toward the students' high school graduation, but would provide college credit from the postsecondary institution.

W. Va. §18B-133-19. The West Virginia Higher Education Policy Commission through *Series 19 of Rules and Policies for Postsecondary Institutions* provides more oversight for dual enrollment courses than the WV Board of Education. WVHEPC Series 19: *Guidelines for College Courses for High School Students* is a procedural rule that includes nine sections providing everything from defining the purpose and principles of dual enrollment, to fees, and subsequent accountability (Series 19, 2016). However, it is important to note that the postsecondary institution and the county boards have wide latitude regarding course specifications that are determined through mutual agreement. Most importantly are how college

credit opportunities are defined as "credit hours attempted and/or earned for early enrollment reporting purposes…delivered primarily to eligible high school students" (Series 19, 2016, p 2). It further provides the authority to the local high school to determine if high school credit is provided. In addition to defining what college credit opportunities (dual enrollment) are, it further excludes EDGE (Earn a Degree, Graduate Early), The College Board Advanced Placement Classes, CLEP Examinations, and Articulated Credit.

In regard to other specifications, Series 19 requires that courses meet the same rigor as those required for regular instruction, i.e. Higher Learning Commission accreditation, and as part of the requirement, courses must involve coordination between academic departments and the course instructor teaching under that discipline. Faculty are also expected to have the required credentials necessary to provide instruction for specific courses, access to professional development, and are also to hold adjunct/part-time faculty status at the institution providing credit. Enrolled students must meet early enrollment standards developed by the postsecondary institution and will possess the "same rights and responsibilities as on-campus students" (Series 19, 2016, p.3). A special tuition clause is provided allowing greater access to the course, with a minimum of $25 per credit hour.

National Demographic

According to the U.S. Department of Education's Press Office, there is significant disparity in regard to degree attainment among economic classes (2016). Less than 10% of individuals in the bottom quartile of household incomes will obtain a bachelor's degree by the age of 25, as opposed to 50% of those in the top quartile. The Press Office further cites access to rigorous curriculum and support services as a major contributing problem. The Obama Administration put into effect a provisional program involving 44 postsecondary institutions

where income-qualifying high school students have access to Pell Grants for dual enrollment in an attempt to begin addressing these troublesome statistics (U.S. Department of Education, Press Office [Press Office], 2016). No data are available at this time regarding the effectiveness of the trial program.

Similarly, in regard to race, in 2015 students who identified as Black and Latino were graduating in lower percentiles than Whites when compared to 2007 data (Kolonder, 2016). Kolonder continues that state budget cuts and increased tuition have negatively influenced the graduation rates of minorities. According to the National Center for Education Statistics (NCES) data, total fall enrollment increased 17% from 2004 to 2014, but interestingly saw a decline of 4% from 2010 to 2014 (Snyder, de Brey, & Dillow, 2016). The report further indicated that the percentage of enrolled Whites saw a drastic decrease from 84% in 1976 to 58% in 2014. So, as enrollment is declining, the percentage of minorities is increasing; however, minorities are less likely to graduate.

K – 12. Through a study conducted in 2013 by the U.S. Department of Education's National Center of Education Statistics Institute of Education Sciences, Marken, Gray, and Lewis (2013) conducted a survey of postsecondary institutions offering dual enrollment for the 2010 – 11 academic year. Marken et al. (2013) found that 53% of all institutions reported high school students taking courses for college credit, 46% dual enrollment and 28% other types of college courses. This translates into 1,277,100 high school students taking dual enrollment and 136,400 taking college credit outside of dual enrollment. Of the participating institutions, 45% indicated that parents were responsible for paying out-of-pocket for tuition, 50% where parents paid for fees, and 60% required parents to pay for the books (Marken et al., 2013).

Unfortunately, this study did not include specific student demographics of those participating in the study, but focused more on the institution type.

       Postsecondary. Detailed demographic data regarding participation in dual enrollment courses is unavailable. As noted earlier, inconsistency among dual credit programs causes issues when looking at these programs on a national scale. Therefore, only studies using National Education Longitudinal Survey (NELS) 88/2000 data provide adequate review of the effectiveness of dual enrollment on a national scale.

       Swanson (2008) reviewed the NELS data along with the Postsecondary Education Transcript Study (PETS:2000) to determine the effect of participation in dual enrollment courses upon college persistence and attainment. Most salient to this study is the demographic delineations. Although, Swanson (2008) found little variation among demographics, males and Hispanics showed decreased likelihood of achieving postsecondary success. The study further purports that this finding is troubling, as the number of males entering college is decreasing while the number of Hispanics in high school is increasing.

       According to an Institute of Education Sciences study reviewing the status and trends in the education of racial and ethnic groups, between 2000 and 2016 the percentage of White children in the U.S. aged 5 to 17 decreased 10%, and Black children decreased 1%. All other racial and ethnic groups increased, including a 9% increase in Hispanic children (Musu-Gillette et al., 2017). Further, in 2014 there was a greater percentage of female students across all racial and ethnic demographics. In regard to the six-year completion rate, 60% of first-time, full-time undergraduates completed within that time-frame and that rate was highest for Asian (71%) and lowest for Black and First Nation students (41%).

The number of bachelor's degrees awarded increased among Hispanic (doubled), Black (46%), Asian/Pacific (43%), and White (19%) from the period between 2003-04 and 2013-14 (Musu-Gillette et al., 2017). The enrollment rate, entering postsecondary schools in the fall immediately following graduation, increased 9% from 1990 to 2015. In 2015, no differences were observed in the immediate enrollment rate of high school completers who were White, Black, and Hispanic (Musu-Gillette et al., 2017).

West Virginia Demographic

K-12. Although performance data are limited in regard to the success of the dual enrollment program in West Virginia, the HEPC and CTC produces an annual report card providing information regarding the number of students enrolled. According to the 2015 HEPC and CTC report, participation in dual enrollment in the public four-year sector increased 4.1% from the 2013-14 to the 2014-15 school year. Since 2010, participation increased 13.9% from 2,155 to 2,455. Therefore, of all of the 11th and 12th graders in West Virginia in the 2014-15 school year totaling 35,893 (West Virginia Department of Education [WVDE], n.d.a), only 2,455 students, approximately 6.8%, participated in public dual enrollment. Of all 273,170 students enrolled in West Virginia schools in 2016-2017, 246,979 (90.4%) students were White, 141,208 (51.7%) were male, and 217,228 (79.5%) students came from low socioeconomic status households (WVDE, n.d.b). According to the 2015 HEPC and CTC report card, the overall college going rate decreased to 54.6% in 2014, while the in-state rate also decreased a smaller percentage to 48.1%.

Postsecondary. The college going rate in West Virginia is approximately 10% lower than the national average of 63.6% (HEPC & CTC, 2015). For both in-state and the general college going rate, West Virginia student enrollment has consistently dropped over the five-year

period from 2010 through 2014. This trend in the college going rate appears to follow the availability of state aid which has also decreased over the same period (HEPC & CTC, 2015). These data easily transcribe into the overall full-time equivalent (FTE) numbers experienced by the state. In West Virginia the full-time enrollment rate (FTE) dropped 5.6% from 64,697 to 61,042 over the same five-year period (HEPC & CTC, 2015). The report also indicates that first-time freshman dropped in the state by 7.4% over the same period. Nationally, there were increases in both areas.

In regard to retaining freshman, in 2013 West Virginia experienced a fall-to-fall retention rate of first-time, full-time freshman of 74.7%, slightly behind the national average of 78.1% (HEPC & CTC, 2015). As indicated, the accumulation of credits within the first year is a determinate of student completion (Swanson, 2008). In West Virginia, 43.9 % first-time freshmen students finished the 2014 academic year with at least 30 hours, which dropped slightly since 2010 from 44.4% (HEPC & CTC, 2015).

Graduation also poses some interesting data as the four-year graduation rate for West Virginia rose from 22.3% in 2007 to 26.1% in 2011. Again, this figure is below the national percentage of 32.6% (HEPC & CTC, 2015). In 2011, low income (18.8%) and underrepresented minorities (15.7%) also experienced a slight uptick in four-year graduation rate when compared to the previous year. In regard to six-year graduation rates, which according to the Cook and Pullaro (2010) is the accepted average time to obtain a bachelor's degree, West Virginia saw a decline of one percentage point from 47.8% in 2005 to 46.8% in 2009. In comparison to the four-year percentages, 35.5% of low-income and 32.2% of underrepresented minority students graduated in six years, which indicates a longer completion time when compared to the overall population (HEPC & CTC, 2015).

Barriers to Enrollment, Persistence, and Completion

Undergraduate enrollment is projected to increase 14% from 2015 to 2026, and of the 17 million students enrolled in 2015, 9.3 million were White, 3 million Hispanic, and 2.3 million Black (National Center for Education Statistics [NCES], 2017). As the literature has shown, while the number of minorities enrolled in higher education is increasing, Whites and females lead four-year college enrollment by significant margins (Kolonder, 2016; NCES, 2017). In regard to persistence and retention, 81.7% of students who started a four-year college in 2015 persisted, and of those students, 69.7% were retained by the same institution (National Student Clearinghouse Research Center, 2017). By looking at racial disparity 91.3% of Asian students, the highest, 77.8% of Black students, 80.1% of Hispanic students, and 86.1% of White students persisted in the same 2015 four-year U.S. college population study.

The six-year graduation rate for students starting baccalaureate education in 2009 at institutions that disburse federal aid was 59% (NCES, 2017). Of those same students, 62% of females and 56% of males graduated. In a six-year completion rate study competed by Shapiro et al. (2017), somewhat different findings were presented for the following year, reporting a 54.8% six-year graduation rate. The Shapiro study further delineates the graduation rate by race showing that Asian students (63.2%), and White students (62%), complete at a higher rate than Hispanic students (45.8%), and Black students (38%).

As indicated by the presented data, there are disparities among enrollment, persistence, and graduation rates based on sex and race (Kolonder, 2016; National Student Clearinghouse Research Center, 2017; NCES, 2017; Shapiro et al., 2017). It is essential to understand mitigating circumstances or issues influencing these rates in order to maximize the number of all students graduating postsecondary education. Of these issues, income and cost of education

(Desilver, 2014; Sledge & Fishman, 2014; U.S. Department of Education, National Center for Education Statistics [NCES], 2013), remediation (Bautsch, 2013; The College Board Advocacy and Policy Center, 2013; Engle & Tinto, 2008; Roy, 2005), and institutional support (Titus, 2006) appear to influence the outcome, especially for low-income students. With this in mind, dual enrollment may prove effective in increasing enrollment, persistence, and graduation due to the lower cost of dual enrollment credits than traditional college tuition, especially for low-income students.

      Income and Cost. Attending college in the decade between 2002 and 2012 was costly in terms of tuition, room and board at public undergraduate institutions in the United States as these costs increased 40% over the period (NCES, 2013). The published cost of college on average increased more than other goods and services during this same period (Sledge & Fishman, 2014). These increased costs create a barrier for students from low income backgrounds as supported by the declining enrollment of these students. In 2012, 50.9 % of secondary school completers whose family income fell in the bottom 20% enrolled in college as compared to 58.4 % in 2007 (Desilver, 2014). Desilver points conversely to increased enrollment in higher education among middle (64.7%) to high (80.7%) income students during this same period. In the ten year period spanning 2002 – 2012, college enrollment of students in middle and upper income families increased while the percentage of students from lower income families declined. Data related to Pell Grants, a federally supported need-based grant program designed to support low-income postsecondary students, evidences the phenomenon even further (U.S. Department of Education, 2014). The total number of Pell Grants increased 1.5 million from the period of 2003 to 2008 which indicates that although the enrollment trend is toward a reduction in low income students,

there is greater attention to income and the cost of degree attainment (College Board Advocacy and Policy Center, 2013).

According to Sean O'Leary in his March 2017 policy brief, higher education has been hit hard in West Virginia with multiple years of budget cuts: $132 million since 2008. He further points out that these cuts have translated into sharp increases in tuition, $7,490 in 2016 for tuition and fees – a 27% increase over five-years (College Board, 2017d), and for the student, making college less affordable and increasing debt. State funding for each student has dropped 22% from $6,373 per full time equivalent student in 2002 to $4,963 in 2015 (O'Leary, 2017). As funding per full time equivalent student has decreased, tuition has skyrocketed 147% since 2002 for the ten state-funded baccalaureate degree granting institutions in West Virginia. The average debt of a West Virginia college graduate has increased 70% since 2005, and this also translates into the state having the second highest default rate in the country (O'Leary, 2017). All of this according to O'Leary, has outpaced Pell and other scholarships available to the student.

The disparity between the cost of higher education and available family income is demonstrated by the increase in Pell support and decrease in reduced enrollment of students from low income backgrounds (College Board Advocacy and Policy Center, 2013). Income and cost are important barriers to college enrollment. The out-of-pocket burden on low income families increased upwards to 36% for baccalaureate institutions (Middle Class Taskforce, 2009). Thus, dual enrollment in West Virginia is a cheaper alternative to credit accumulation as some counties pay the costs and in other counties the student pays the reduced cost, a $25 minimum per credit hour (Series 19, 2016). However, other variables also serve as barriers to access and postsecondary degree completion, including the need for remediation and an understanding of

higher education. In West Virginia, the cost of higher education, and the political and budgetary landscape of the state create concern along the aspects of income disparity.

Remediation. Secondary education performance is an important consideration for postsecondary success. According to Roy (2005), data from a longitudinal U.S. Department of Education study indicated that 29% of low income students performing at the highest quartile in eighth grade math in 1998 graduated from college by 2005 as compared to 74% of high income students. The College Board Advocacy and Policy Center (2013) indicates that on average, students are taking longer to complete associate and baccalaureate degrees than the traditional two and four years as in the past. Between 28% and 50% of all first-time undergraduate students required remedial education, costing approximately $2.3 billion each year (Bautsch, 2013). These remedial classes rarely count toward degree requirements which therefore increase the cost and length of study (Engle & Tinto, 2008). According to the Executive Office of the President (2014), nine out of ten students requiring substantial remediation never complete their education. Engle and Tinto's (2008) assertion that low income first generation students are more likely to drop out within the first two years is an indicator of their struggle in higher education. In comparison to other students, those from low income backgrounds are less likely to earn a degree from baccalaureate institutions (Titus, 2006).

Institutional Characteristics. Marvin Titus' (2006) study used national student and institution-level longitudinal data from 1996-2001 provided by the U.S. Department of Education's Beginning Postsecondary Students survey database to understand the influence of the financial context of institutions on low income college completion. According to Titus, there is a positive association between low income student completion, and tuition revenue as a

percent of total revenue, and educational expenditures per full time equivalent student. Titus (2006, pp. 393 – 394) outlined five conclusions from this study:

- College completion is positively influenced by income (i.e. socioeconomic status) even when considering other variables related to student attributes (i.e. high school academic performance, gender, race/ethnicity, and income), college experience, financial need, hours worked, and off campus employment.

- Norms and values associated with higher income levels increase the likelihood of postsecondary degree completion.

- Postsecondary degree completion is positively influenced by demographic-structural characteristics (i.e. race/ethnicity).

- After controlling for variables such as SES and race/ethnicity, postsecondary completion is positively related to financial viability of institutions (i.e. tuition revenue as the percent of total revenue and educational expenditures (i.e. E&G), per full-time equivalent (i.e. FTE) student).

- Low income students are disproportionately enrolled in colleges with fewer resources and a greater reliance on tuition revenue.

From these conclusions, Titus (2006) asserted that students from low income backgrounds are enrolled in schools that do not have the resources necessary to assist with completion. This assertion backs up Webber and Ehrenberg's 2010 study using sampled Integrated Postsecondary Education Data System (IPEDS), Delta Cost Project data for descriptive statistics and econometric analysis. Webber and Ehrenburg found that student service expenditures influence first year persistence and graduation rates at a higher rate for institutions with lower entrance test scores and higher Pell Grant expenditures per student. This suggests that

a higher investment in student services, even by reallocating instruction funding, would improve graduation and persistence rates (Webber & Ehrenburg, 2010).

Ryan (2004) found similar results in his nonprobability cohort study of 363 Carnegie-classified Baccalaureate I and II institutions using IPEDS data. Ryan examined institutional six-year cohort graduation rates with instructional and academic support expenditures. The study indicated that there is a positive and significant relationship between graduation rates and both expenditure types. Ryan further makes a similar recommendation as Webber and Ehrenburg (2010) excluding reallocating instruction funding in favor of additional support for the expenditure type. Contemporarily, reallocation is more of a discussion than additional investment due to the disinvestment in higher education. Another consideration for intervention is to increase exposure to advanced curriculum through the provision of low-cost dual enrollment credits.

Effectiveness of Other Forms of Dual Enrollment/Credit

Although dual enrollment is the most prevalent course delivery model (National Alliance of Concurrent Enrollment Partnerships [NACEP], n.d.), there are various options available to high school students seeking early postsecondary credit opportunities. Of the most current forms of dual enrollment offered, ECHS programs, are derived from a Bill and Melinda Gates 2013 initiative designed to improve college readiness and completion rates of underrepresented students. This is achieved through a partnership between early colleges and postsecondary institutions in order to allow students to earn an associate's degree, or at least, two-years of college credit for little to no cost by high school graduation (Berger et al., 2014). There are five *Core Principles* of the ECHS initiative which include commitments to underrepresented

students, comprehensive support systems for students built through collaboration, and a commitment toward advocacy of the early college movement (Berger et al., 2014).

ECHS Outcomes. As previously indicated there are two major studies related to the outcomes of ECHS programs. The first, Berger et al. (2014), tracked a total of 1,414 students from 272 high schools drawn from the National Student Clearinghouse from 2005 to 2007. Findings indicated that enrollment (80.9% of participants enrolled), and degree attainment (24.9% possessed any postsecondary degree) were both positively and significantly influenced by ECHS participation. In addition to Berger et al. (2014), Edmunds et al. (2017) had positive findings on increased enrollment and attainment of degrees. This study involved 1,615 North Carolina students enrolled in 19 early college high schools.

Advanced Placement. Warne, Larson Anderson and Odasso (2015), used propensity score matching techniques to review the effect of Advanced Placement (AP) credit, similar to the scoring used in this study. Propensity score matching, according to Warne et al., is a "statistical technique that attempts to establish causal inference when data are non-experimental in nature" (p.407, 2015). The authors further indicate that this form of statistical analysis was used by other researchers studying AP credits. This analysis reduces the pre-existing differences in groups that increase the appearance of the overall intervention effectiveness.

Through the analysis of two high-school graduating cohorts in Utah (N= 90,044) it was determined that AP credits are beneficial for students who take the exam as opposed to those who do not (Warne et al, 2015). The researchers further examined the effect of certain characteristics such as race, sex, and income, and determined that they do not influence the outcome of the effectiveness of AP as an intervention. The authors concluded that testing under the AP framework and the resulting score are the most important influences on student academic

achievement measured by ACT test scores (Warne et al, 2015). These findings indicate that students who test well under the AP framework will perform well for college readiness testing as measured through ACT testing.

National Dual Enrollment Studies

Several researchers utilized the 1988/2000 National Education Longitudinal Study data to examine key factors related to college level coursework in high school, particularly in relation to later college success. An's (2013) study used the 1988/2000 National Education Longitudinal Study to examine dual enrollment and low socioeconomic status. An noted that the 1988/2000 dataset provides data not regularly collected and/or reported outside of the longitudinal study. Broadening the study outside of low socioeconomic constraints is Adelman's 2004 research for the Department of Education also used the 1988/2000 longitudinal data. His study indicated that students who had high school credit were more likely to graduate from college and do so more quickly. It is essential to note that Adelman does not differentiate from dual enrollment and other types of acceleration credits, like advanced placement credits, obtained in high school. Swanson (2008) also used 1988/2000 NELS data but refined the data into several attributes including demographic and high school attributes.

Swanson's (2008) improved statistical analysis, logistic regression based upon a causal model, was designed to consider additional variables such as gender, race, first generation status, socioeconomic status, high school grade point average, and test scores. These variables align with those proposed in this study. The inferential statistics indicated that dual enrollment participation is significant in persistence to a degree, and college enrollment within seven months after high school graduation (Swanson, 2008). Swanson categorizes the persistence factors associated with the acquisition of dual enrollment credits as "academic momentum," which

appears to have influenced persistence to the second year when a student accumulated 20 or more credits in the first year therefore providing a "nest egg" (2008, p. 3).

Academic momentum appears to be important in Swanson's study as those students who accumulated at least 20 credits by the end of the first year were more likely to graduate in 4.56 years, by 38% (2008). The study further indicates that participants in dual enrollment courses are 16% to 18% more likely to graduate with a Bachelor of Arts degree. It is also postulated in Swanson's study that dual credit programs foster positive attitudes toward earning a postsecondary degree as pointed out using Merton's theory of anticipatory socialization. The data supporting this claim indicates that participants in dual enrollment credit who initially considered obtaining a postsecondary degree were 12% more likely to do so compared to those who considered obtaining the degree but did not obtain dual enrollment credit (Swanson, 2008). According to Swanson, descriptors were not statistically significant in the study.

Florida and New York Dual Enrollment Systems

According to a 2007 report on dual enrollment outcomes in Florida and New York by Karp, Calcagno, Hughes, Jeong, and Bailey, male and low-income Florida students appear to obtain a strong benefit from participating in a dual enrollment program. Also interesting is the finding that for some of the measures, students with lower high school grades benefitted more than those with higher grades. Other findings support that dual enrollment students in the study were more likely to persist, have higher postsecondary grade point averages, and were more likely to earn more credits when compared to those who did not engage in dual enrollment programs within the state. The sample for this study came from the 2000-01 and 2001-02 graduating high school cohorts who entered postsecondary Florida institutions that included

36,217 students with dual enrollment experience and 4,654 Community and Technical Education students, a dual enrollment subgroup (Karp et al., 2007).

In New York, researchers tracked 2,303 vocational high school graduates who were participants in the CUNY College Now program and were enrolled in the CUNY system in 2001 and 2002. Participants in CUNY's program were 9.7% more likely to obtain a bachelor degree as opposed to an associate's degree (Karp et al., 2007). Similar to Florida, participants were more likely to have a higher postsecondary grade point average, at least in the first term, and also earned credits faster than their counterparts. According to the researchers, dual enrollment can benefit a wide range of participants and outreach should be expanded to underserved populations.

It is not surprising that Karp et al. (2007) chose Florida to draw participants to research. National standards for dual enrollment are lacking, resulting in varied formats determined by states and postsecondary institutions. Florida's statewide initiative is often cited as being one of the best-developed dual enrollment programs (Allen, 2010). Allen indicates that over 37,000 Florida students participated in the program with courses taken during and after school hours and also during the summer term. Tuition, fees, and texts are free for public school students participating in the program, while private and homeschooled students must pay for textbooks. The average student participating in the dual enrollment program completed five courses at the time of the study (Allen, 2010). Florida further requires that students meet criteria, including a specified grade point average determined by course type, and prove college readiness by scoring minimum scores on the college placement test, and ACT/SAT/FCAT scores.

West Virginia Dual Enrollment

Almost ten years after the introduction of dual enrollment into West Virginia state code, the HEPC and CTC assessed the overall statewide performance of college courses for high school students in the 2004-05 school year (HEPC & CTC, 2005). At the time of the study, the HEPC and CTC reported that the dual enrollment program provided sufficient discretion to make a determination if certain courses would be offered as dual enrollment credits but also addressed issues such as faculty qualifications, enrollment/admission requirements, tuition support and other administrative procedures.

Since its inception, the program has committed to helping students earn a degree and graduate early (Series 19, 2016). The principles established by Series 19 (2016) for early enrollment are designed to:

- expand access to college;

- increase the college-going rate;

- increase student success in college; and

- enhance college affordability.

Rule requirements set forth criteria in regard to courses, faculty, admissions, tuition, and accountability. Throughout the rule, the pattern of institutional self-governance in relation to the program is evident. Autonomy may be ideal for institutions, but formalization of dual enrollment programs has proven beneficial in meeting some of the overt principles elucidated above (HEPC & CTC, 2005). All dual enrollment programs in West Virginia must adhere to the procedural rules established by Title 133 Series 19 (2016).

Other than some legislative modifications dealing with instruction, continuing education and evaluation, student access to facilities and the inclusion of specialized fee language, the

program has received little attention other than reporting on the statewide number of students who participate in the program. According to the HEPC and CTC's 2015 Report Card, dual enrollment in West Virginia's public four-year sector increased 4.1% from the previous year and 13.9% since 2010.

A literature review reveals that the state conducted two effectiveness studies on dual enrollment. One of the studies reviewed the 2001-02 school year and is inaccessible on the web and the other, as indicated above, was conducted over ten years ago with little attention to the provision of specific measures of success. Of the measures presented, the 2005 HEPC and CTC report indicates that 19 colleges and universities enrolled over 6,000 students in over 9,100 college-level courses. It further indicates that there was a shift among the providers of dual enrollment courses as 11 of the 19 colleges and universities were community and technical institutions. It should be mentioned that these courses were reported differently due to administrative changes in the West Virginia Community and Technical College System in 2004. The report also brings forth information regarding the notion that some courses offered to high school students are in fact not dual credit as the high school may not count the course for high school credit. Therefore, there is an important delineation for this study: courses will be described as dual enrollment, not dual credit in regard to the system data/findings.

In regard to the formal evaluation of dual enrollment in the state, West Virginia colleges and universities are tasked with applying the same assessment standards for dual enrollment courses as with other courses (HEPC & CTC, 2005). The report further indicates that the HEPC and CTC views evaluation as integral to ensuring the students receive quality instruction. Student assessments designed to measure learning also must align with traditional course offerings. No

specified final cumulative assessment is required as with traditional advanced placement exams (HEPC & CTC, 2005).

West Virginia Postsecondary Dual Enrollment – Enrollment/Completion

Of the fall 2003 West Virginia dual enrollment cohort, 65.8% enrolled in a public institution in the state the next year (HEPC & CTC, 2005). It is important to note that some of participants in the fall cohort were juniors and the data only accounts for students who attended a West Virginia public institution, therefore the college going rate is possibly underreported. The same outcome measure was applied to all 2003-04 West Virginia high school graduates and the dual enrollment cohort and it was reported as lower; although, the HEPC and CTC did not provide a specific percentage of graduates attending a West Virginia public institution. It is noteworthy that of those students who participated in the dual enrollment courses, they did not necessarily attend the same institution after graduation. Most attended either West Virginia or Marshall Universities (HEPC & CTC, 2005).

As discussed earlier, the 2005 report did not review outcome indicators regarding completion but did report the average grade point average for the first semester of the freshman year of 2.78 and 2.95 in the next consecutive semester. It also reports that two-thirds fewer cohort members were enrolled in a developmental course in the fall of 2004. These outcome indicators are weak in considering the push toward graduation. West Virginia legislators, secondary and postsecondary schools, and education professionals would benefit from making informed decisions based on the standard six-year graduation rate used by the National Center for Education Statistics (NCES) for IPEDS reporting (United Stated Department of Education National Center for Education Statistics [NCES], n.d.).

SUMMARY

Data indicates that postsecondary enrollment, persistence, and graduation rates are influenced by the race, ethnicity, and income of students (Desilver, 2014; Sledge & Fishman, 2014; U.S. Department of Education, National Center for Education Statistics [NCES], 2013), remediation (Bautsch, 2013; The College Board Advocacy and Policy Center, 2013; Engle & Tinto, 2008; Roy, 2005), and institutional support (Titus, 2006). Available research further indicates that early interventions such as Early College in High School (Berger et al., 2014; Edmunds et al., 2017), advanced placement/ dual enrollment (Warne et al, 2015); and dual enrollment (Adelman, 2004; An, 2013; Karp et al., 2007; Swanson, 2008) are effective in improving enrollment, persistence, and/or graduation from four-year postsecondary institutions. It is essential to note, however, that the studies involving dual enrollment are either dated, using NELS 1988/2000 data (Adelman, 2004; An, 2013; Swanson, 2008), or focus on individual states (Allen, 2010; Karp et al., 2007). The discussion is further complicated with the addition of ECHS programs, which have also shown promise in regard to enrollment and degree attainment (Berger et al., 2014; Edmunds et al., 2017). Current studies on dual enrollment in West Virginia are lacking, but they are necessary to assess outcomes of the state's important initiative to increase the college-going and completion rates of students.

Dual enrollment is complex and its definition and delivery varies by state, but also by factors as basic as issues related to the collaborative relationship between the higher education institution coordinating dual enrollment and the high school where course delivery occurs. As noted, this program variation creates barriers when determining program effectiveness, especially on a national scale. Also, due to the age of the data utilized in national dual enrollment studies (NELS/2000), more current figures are necessary to effectively and efficiently promote

dual enrollment as an avenue to improve enrollment, persistence, and graduation rates for West

Virginia students. As evidenced in this literature review, a need exists for studies to determine

the effectiveness of dual enrollment in West Virginia, particularly given the WVHEPC and CTC

Chancellors' initiatives to *Double the Degrees* by 2025 (West Virginia Higher Education Policy

Commission, 2015) and the dearth of information available regarding dual enrollment's

effectiveness in the state.

CHAPTER 3

METHODS

The following pages describe the research design, population and sampling information, instrumentation, data collection and analysis, and define the researcher's role. This research seeks to review the effect of dual enrollment credits earned prior to enrolling as a first-time full-time freshman on postsecondary persistence and attainment of a baccalaureate degree within six-years through propensity score matching and statistical analysis. Special consideration is given to student factors including sex, college readiness as assessed through grade point average, socioeconomic status (SES) determined by family income, rurality, and minority status through conducting a series of analyses. These observed characteristics are controlled by using the propensity score model. These mathematical approaches are in line with the methods utilized by An in his 2013 study involving the effect of dual enrollment credits on low-SES student degree attainment. The population of the study is derived from 2010 cohort data provided by the West Virginia Higher Education Policy Commission (HEPC).

Research Design

The research is inferential and uses a quantitative research design. The research questions require the analysis of data that are numerical, or can be coded as such, as opposed to rich textual information required for qualitative analysis. As discussed in later sections, the data are derived from student information submitted by West Virginia postsecondary institutions to the HEPC, the commission charged with oversight of four-year postsecondary public institutions. These data require frequency and statistical analysis in order to answer the research questions and provide the necessary descriptive information regarding the study's participants. Descriptive data include: the presence or absence of dual enrollment credit, sex, college readiness, socioeconomic

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status, rurality, and minority status. As discussed in the review of the literature, these factors have shown to affect retention and graduation of postsecondary students. This design is similar to those employed by An (2013), Swanson (2008), and Titus (2006).

Population

The HEPC & CTC (2017) indicate that for the most current academic year, 2015 - 16, the total public postsecondary undergraduate enrollment was 52,889 students who enrolled in classes by the end of the fall 2015 term. During the same term, 10,862 of those students were considered first-time freshmen. The dual enrollment of high school students in postsecondary public institutions was 3,445 junior and senior high school students during the 2015 school year (HEPC & CTC, 2017). The 2015 data provides a snapshot of the most current overall population data from where the longitudinal data for this study is sampled. In regard to the cohort 2010 – 11 academic year, the HEPC & CTC (2011) indicate that for the total public postsecondary undergraduate enrollment in West Virginia was 56,355 students who enrolled in classes by the end of the fall 2010 term. During the same term, 11,697 of those students were considered first-time freshmen. The dual enrollment of high school students in postsecondary public institutions was 2,155 junior and senior high school students during the 2010-11 school year (HEPC & CTC, 2011). The population of the study, drawn from this cohort year, was obtained from preexisting data provided by the West Virginia Higher Education Policy Commission (HEPC) which falls through the fall 2007 to the spring 2016 semester. The data are derived from student, financial aid, and graduation files uploaded by each public postsecondary institution in the state. Every student enrolled in a baccalaureate degree granting West Virginia public postsecondary institution at the time of self report was included as part of the dataset. These institutions are Bluefield State College, Concord University, Fairmont State University, Glenville State College,

Marshall University, Potomac State College of West Virginia University, Shepherd University, West Liberty University, West Virginia University, West Virginia University Institute of Technology, West Virginia University at Parkersburg, and West Virginia State University.

Dually enrolled high school junior and senior student data are collected as they enrolled as dual enrollment participants through the period of fall 2007 through spring of 2009 and are identified from the same population of first-time, full-time freshmen in the 2010 cohort. This 2010 cohort was tracked with their nondual credit counterparts through 2016 in order to address the research questions.

Sampling Method

The study used purposive sampling, a non-probability sampling technique that lends itself to easily extracting specific characteristics within a population. Purposive sampling allows for first-time full-time students entering who enrolled in the fall 2010 to be selected from the larger population of all students who enrolled in the selected West Virginia public schools. This allowed the researcher to focus on specific characteristics of the public postsecondary student population in West Virginia. For this study, the characteristics were defined as first-time, full-time freshman status, attending a public baccalaureate degree granting institution, and enrolled in the fall 2010 semester. Therefore, this sample was not representative of the entire postsecondary population in West Virginia, as it was limited to these characteristics.

Sample Selection

The 2010 dual enrollment cohort were identified from the study sample and the associated identification number recorded by the HEPC. This cohort includes students who received dual enrollment credits in 2007 through 2009. All personally identifiable information was removed and unique identifiers were assigned by the HEPC prior to obtaining the data sets.

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Dual enrollment credits are recognized through the evaluation of the 2007 through 2009 dataset to identify if a student was dually enrolled through a specific type of registration in the student file.

The 2010 cohort of first-time, full-time college freshmen were tracked through 2016 graduation to determine dual enrollment effectiveness. This entire cohort included first-time college freshmen who received dual enrollment credits in their junior (2008) and/or senior (2009) year of high school which were recorded as dual enrollment credits by all West Virginia public postsecondary institutions as well as all other in-state, first-time, full-time students enrolled in the applicable institutions. HEPC *student, financial aid, course* and *graduation* files were used to determine academic success. Student factors including sex, college readiness as assessed through grade point average, socioeconomic status (SES) as determined by Pell eligibility, rurality, and minority status were derived through student files. The number of dual enrollment credits and annual academic progress through the accumulation of credits were also reviewed using the same file set.

This type of non-probability sampling was used because of the inability to randomly assign participants into a control or experimental group. The use of previously collected data indicate that random selection, which is necessary to draw inferences (i.e. causation), was unattainable as it is impossible to do so retroactively. The failure to control for pre-existing differences among groups can indicate a larger or smaller effect of dual enrollment on persistence and graduation. This phenomenon was observed by Warne et al. (2015) in the determination of the effectiveness of AP credits. Like Warne et al (2015) and An (2013), this research used propensity score in order to balance the groups as much as possible. This approach allowed the researcher to create two comparison groups based on preexisting characteristics that

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have shown to be associated with the examined variables, in this case enrolling in dual credit

programs. A smaller subset of the larger dataset provided by the HEPC was developed using the

propensity score matching. This subset used in the main analysis included only students who

closely match other students in the dual enrollment group based on the identifying

characteristics.

Instrumentation

Data are derived by institutional reporting to the HEPC. The data are collected during

several points throughout the year (i.e. fall, spring, and summer) in accordance with the calendar

of due dates posted by the HEPC. Data are submitted as comma separated data, i.e. csv files, by

West Virginia postsecondary public institutions and is managed by the HEPC Division of Policy

and Planning. The datasets, i.e. instrumentation, managed by the HEPC are *Applicant File,*

Couse File, Financial Aid File, Batch Updates HEGP (Higher Education Grant Program), *Batch*

Updates PROMISE (merit-based state financial aid program), *Student File, Registration File,*

Graduation File, Personnel File, Teaching Workload, Schedule File, Skillset Enrollment &

Completion File, WV High Schools and ACT Codes by Name, and WV High Schools and ACT

Codes by Code. Each of these datasets have corresponding codebooks explaining the unit of

analysis and how each element should be reported. This assists with consistency as each element

and collection procedure is operationalized in these codebook files. The data used for this

research are submitted as the *Student File*, *Financial Aid File*, and *Graduation Fil*e. The

elements selected are from a larger set of data and are outlined in tables one through three below.

The requested data in the *Student File* are as shown in Table 1.

Table 1

Data Elements – Student File

Unit of Analysis	Description
Institution	Reporting Institution
Reporting Year and Semester	Fall, Spring, Summer of 2010 through Spring 2016
Gender	Male, Female
County of Residence	All West Virginia Counties (determines rural status)
Student Level	Student's Year of Standing (i.e. Freshman, etc.)
Economically Disadvantaged	Yes or No Indicator*
Type of Registration	(i.e. First-Time Freshman, Returning Student, etc.)
ACT Scores	Reported Scores on Each Section if Applicable
SAT Scores	Reported Scores on Each Section if Applicable
High School GPA	Reported on the 4.0 Scale
Year of High School Graduation	Year Student Graduated
Withdrawal, End of Term	Withdrawal from Institution if Applicable
Cumulative Hours Earned at Current	Total Number of Hours Earned at Reporting Institution
Institution	Hours Earned at Other than Reporting Institution
Hours Earned at Another Institution	Yes Indicator for Hispanic, Native Indian or Alaska Native,
Minority Status	Asian, Black or African American, and Native Hawaiian or
	Other Pacific Islander

Note. *Economically Disadvantaged is indicated as yes if the student, parent, or guardian is a recipient of public

assistance; or institutionalized or under State guardianship, or the student qualifies for Pell Grant, SEOG, NDSL,

CWSP, or West Virginia Higher Education Grant Program (HEPC, n.d.b).

The *Student File* is submitted to the HEPC by West Virginia public postsecondary institutions on September 1st for summer submission, October 15th for fall early-term submission, January 25th for fall end-of-term submission, and June 30th for spring end-of-term submission. For the purposes of this research, the fall early-term submission was not included for student tracking purposes. For this instrument, the HEPC collects 64 fields of student information including demographic, academic preparedness at the secondary level, and postsecondary credit and enrollment status (HEPC, n.d.b). In addition to the *Student File*, the research also used the *Financial Aid File* collected by the HEPC. The data used from the *Financial Aid File* are as shown in Table 2.

Table 2

Data Elements – Financial Aid File

Unit of Analysis	Description
Federal Pell Grant Indicator	Yes if student receives Pell Grant

The *Financial Aid File* is submitted to the HEPC by West Virginia public postsecondary institutions that submit one record per student, per academic semester, and include the academic year and semester that student was included in a *Student File* submission (HEPC, 2016). For this instrument, the HEPC collects 64 fields, the 64th, PDIM a Banner Database identification number, is optional. These 64 fields include information including some student demographics, but primarily student financial aid package information.

The purpose of this file is to collect comprehensive information on financial aid awarded and disbursed to enrolled students at all public colleges and universities in West Virginia.

It also collects information on students with financial need who are enrolled but are not receiving financial assistance (HEPC, 2016, para. 1).

In addition to the *Financial Aid File*, the research also used the *Graduation File* collected by the HEPC. The data used from the *Graduation File* are as indicated in Table 3.

Table 3

Data Elements – Graduation File

Unit of Analysis	Description
Institution	Reporting Institution
Reporting Year and Semester	Fall, Spring, Summer of 2010 through Spring 2016
Undergraduate Credit Hours Attempted	The total number of credit hours attempted by the student
Undergraduate Credit Hours Earned	The total number of hours accumulated by the student
Other Hours Earned/Obtained when the Degree was Awarded	The total number of hours earned at graduation

The *Graduation File* is submitted to the HEPC by West Virginia public postsecondary institutions that submit all students who have graduated within the reporting year. This file is submitted by June 20th following each academic year (HEPC, 2011). For this instrument, the HEPC collects 19 fields. These 19 fields include information including some student demographics, hour accumulation, and graduation/degree information. According to the HEPC (2011), "these data… serve as the official report of student graduation, as well as a historical record for future planning" (para. 1). The *Graduation File* is the last data file used in this research as collected by the HEPC.

Data Collection

The 2010 dual enrollment cohort were identified and the associated identification number recorded by the HEPC. All personally identifiable information was removed and unique identifiers were assigned by the HEPC prior to obtaining the data sets. The researcher completed the Research Proposal Application, and entered into a Data Disclosure Agreement in order to access the data files. There are three .csv files created by the HEPC in response to the data request. The first 2010 cohort file contains the student and financial aid indicators for first-time, full-time, students in 2010 from West Virginia public baccalaureate degree granting institutions. Dual enrollment status is also identified by the HEPC though the evaluation of the 2010 student dataset to identify if a student was dually enrolled through a specific type of registration in the *Student File*. This information is then used by the HEPC to narrow the total first-time, full-time, students to those who completed dual enrollment coursework. These dual enrollment students are identified in the 2008 and 2009 academic year *Student Files* in order to determine the total number of hours accumulated during the secondary junior and senior year. The HEPC then transferred this information into a dual enrollment indicator included in the file.

The 2010 cohort including those who participated and did not participate in dual enrollment courses are tracked through 2016 graduation using a separate file titled *2011-2016 student file*. This file contains data from the *Student File* and *Financial Aid File* for academic year 2011 through 2016 to determine student socioeconomic status and credit accumulation. The third file, which is titled *Graduation File,* possesses graduation information for the 2010 cohort who have earned a bachelor's degree. The three .csv files were made available through secure download by the HEPC. These files use data that conforms to the explicit codebook instructions established by the HEPC and the data elements are further transcribed to the files from the

datasets by the use of coding. This process diminished concerns regarding consistency. The researcher coded a subset of the data to provide elements necessary to conduct analysis.

Data Analysis

In order to address the posed research questions, several different statistical tests were necessary. In addition to the statistical testing, a propensity score analysis was used in order to identify a control group for comparison based on student characteristics. These characteristics are shown to influence college access and completion.

Propensity Score Analysis. Prior to testing the data, a propensity score analysis was utilized in order to provide two groups with similar characteristics, mimicking a random assignment. Propensity score models "aim to accomplish data balancing when treatment assignment is nonignorable (*sic*), to evaluate treatment effects using nonrandomized or experimental approaches" (Guo & Fraser, 2015, p. 11). Randomized experimentation was not feasible for this study. The propensity score was derived from the variables Pell eligibility (Titus, 2006), and College Readiness, i.e. high school grade point average scores, which are shown to influence college access and completion more than standardized test scores (Hiss & Franks, 2014). The score calculation and matching were carried out using SPSS version 25 with the R 3.2 program, with two groups identified based on these scores. The first included those students who completed dual enrollment, while the second, were those who did not but have a comparable propensity score indicating similar academic and demographic characteristics. Students without a match were not included in the analysis.

The propensity scores were matched from a closest score method as opposed to an exact match. The use of closest score was merited as the sample size was greatly reduced due to the criterion used through the matching technique. The variables utilized to determine the propensity

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score were college readiness as determined through high school grade point average, which is a continuous variable using two decimal places on a 4.0 scale. The grade point averages range from 0.00 to a 4.0; scores of 0 were removed from the sample. The second variable used to determine the score was Pell eligibility. This variable is dichotomous and was coded as 0 not eligible and 1 Pell eligible. In addition to the variables used to develop the propensity score, several other variables were used in the process. Sex is a dichotomous variable in this study where females were coded as 0 and males as 1. Rurality is also dichotomous as 0 indicates a nonmetro county and metro counties were coded as1. This classification used the 2013 ERS Rural-Urban Continuum Codes which "distinguishes metropolitan counties by the population size of their metro area, and nonmetropolitan counties by degree of urbanization and adjacency to a metro area" (United States Department of Agriculture, Economic Research Service, 2016, para. 1). Minority status was also used for matching and is dichotomous with not minority coded as 0, minority, any race or ethnicity other than White coded as 1 and unknown coded as 2. Grouping was determined by dual enrollment status which is a dichotomous variable where no dual enrollment credits was coded as 0 and dual enrollment credits as 1.

      Research Question One. The research question posed was whether there is a significant effect on persistence and graduation in West Virginia public baccalaureate postsecondary schools from students who complete dual credit courses is addressed using chi-square testing. After the grouping process using propensity score matching, a chi-square was utilized to determine if there was a between persistence in West Virginia public baccalaureate postsecondary schools and students who completed dual credit courses. If there was a significant relationship, then the odds ratio were reported as the effect size. Persistence, the dependent variable, is defined as completing the first full academic year and returning in the fall semester,

and is a dichotomous variable representing a code of 0 if not returned and a code of 1 if the student returned the Fall 2011 semester. Dual enrollment status, the independent variable, is dichotomous with no dual enrollment credits was coded as 0 and dual enrollment credits as 1. This relationship was further explored post-hoc using a t-test to determine if dual enrollment credits affect the number of college credits accumulated at the end of the Fall 2011 semester.

An additional chi-square test was used to determine if there was a relationship in graduation in West Virginia public baccalaureate postsecondary schools from students who complete dual credit courses. If there was a significant relationship, then the odds ratio were reported as the effect size. Graduation, the dependent variable, was determined as a dichotomous variable, i.e. did not graduate within six-years coded as 0, and did graduate within six-years coded as 1. This relationship was further explored post-hoc using a t-test in order to determine from within the sample of dual enrollees was the number of dual enrolled credits associated with graduation.

Research Question Two. The research question posed was whether there is a significant effect on the persistence and graduation of dual credit students in West Virginia public baccalaureate postsecondary schools based on the following student characteristics: socioeconomic status (Pell eligible, not eligible); sex (male, female); college readiness (high school grade point average), rurality (West Virginia metro county, West Virginia nonmetro county), and minority status (White, other race/ethnicity) was explored by using logistic regression. The effect on the persistence of dual credit students in West Virginia public baccalaureate postsecondary schools was based on the following variables: socioeconomic status (Pell eligible coded as 1, not eligible coded as 0); sex (male coded as 1, female coded as 0); college readiness (high school grade point average), rurality (West Virginia metro county coded

as 1, West Virginia nonmetro county coded as 0), and minority status (White coded as 0,

minority race/ethnicity coded as 1), and was calculated using a logistic regression. The effect on

the graduation of dual credit students in West Virginia public baccalaureate postsecondary

schools based on the following student characteristics: socioeconomic status (Pell eligible coded

as 1, not eligible coded as 0); sex (male coded as 1, female coded as 0); college readiness (high

school grade point average), rurality (West Virginia metro county coded as 1, West Virginia

nonmetro county coded as 0), and minority status (White coded as 0, minority race/ethnicity

coded as 1) is also calculated using logistic regression.

Researcher Role

The researcher, a doctoral candidate in Marshall University's Leadership Program, served

as principal investigator of this study. As discussed, the data used in the research were collected

by the Higher Education Policy Commission through institution level submission. These data

were then provided to the researcher via secure download of .csv files. It is, therefore, unlikely

that the data are susceptible to researcher bias during the collection phase. Variables were

recoded by the researcher as necessary in order to collapse into larger elements. Thus, existing

definitions were utilized to group the variables as discussed in data analysis, therefore reducing

bias. In addition, propensity scores were developed using variables shown to influence

postsecondary persistence and graduation in previous studies.

The SPSS program using R, a language and environment for statistical computing and

graphics (R Foundation, n.d.), was utilized to develop the propensity scores and to analyze the

data. The use of the statistical environment reduced the likelihood that researcher error or bias

could influence the propensity score matching or other statistical analysis used throughout the

study. Findings are included in Chapter Four to support the conclusions expressed by the

researcher in this study. It should also be noted that propensity score matching was used in order to increase the validity of the comparison group. As random assignment and other components necessary for a true experimental design were not used due to the use of preexisting data, the use of the propensity matching technique remediated some concern regarding the researcher's ability to draw conclusions to whether dual enrollment is effective for improving postsecondary outcome.

SUMMARY

This research utilized the most complete set of data available regarding dual enrollment credits and first-time, fulltime freshmen in West Virginia, as it was derived through the submission of institutional data to the one central administrative unit, the HEPC. Careful consideration was used in determining the use of the 2010 cohort as this was the most current class of enrolled freshman where six-years of data was available. Propensity score matching was used in order to deal with unequal comparison groups as random assignment was not plausible.

CHAPTER 4

RESULTS

The results chapter presents the findings derived from the methods posed in the preceding section. The research focus was on the effect of dual enrollment credits earned prior to enrolling as a first-time full-time freshman on postsecondary persistence and attainment of a baccalaureate degree within six-years. Propensity score matching and statistical analyses, including chi-square, t-test, and logistic regression were used to address the question(s). Student factors including sex, college readiness, socioeconomic status (SES), rurality, and minority status were used in propensity score matching and also as predictors in the logistic regression. In addition, the utilization of a series of chi-square testing sought to determine relationships among variables. These mathematical approaches are in line with the methods utilized by An (2013), Swanson (2008), and Titus (2006) in their studies involving dual enrollment credit postsecondary outcomes. Cases with missing data on any of the variables used were removed from the sample.

A quantitative research design was utilized for the inferential analysis. Data were derived from student information submitted by West Virginia public postsecondary institutions to the HEPC, the commission charged with oversight of four-year postsecondary public institutions. Propensity score analysis results were reviewed first, including an examination of group characteristics before and after the propensity score matching. These results are followed by a series of inferential statistical analyses to answer each research question.

Propensity Score Analysis

A propensity score analysis was utilized to provide two groups with similar characteristics, mimicking random assignment. The following variables were used to generate a propensity score for each participant: (1) Pell eligibility (Titus, 2006), and (2) College Readiness,

i.e. high school grade point average scores, which are shown to influence college access and completion more than standardized test scores (Hiss & Franks, 2014). Other variables utilized to determine the propensity score were (3) sex, (4) rurality, and (5) minority status. The score calculation and matching were carried out using SPSS version 25 with the R 3.2 program.

Two groups were identified based on these scores. The first included those students who completed dual enrollment, while the second were those without dual enrollment completion but who have a comparable propensity score indicating similar academic and demographic characteristics. Students without a match were not included in the analysis of the research questions, thus controlling for outliers within the original dataset. The matching was completed based on the closest score method as opposed to an exact match. The use of closest score was merited to ensure an adequate sample size. Each case from the original dual enrollment group was matched with a case from the non-dual group.

Prior to the execution of the propensity score matching model, the demographic characteristics of the 2010 cohort sample provided by the WVHEPC were analyzed. The sample comprised of 7,778 first-time, full-time in-state freshmen who were enrolled in West Virginia public postsecondary baccalaureate institutions during the fall semester of 2010.

Sex. Of the 7,778 students, 4,133 (53.14%) were reported as female and 3,645 (46.86%) male. Of these, 1,626 (20.91%) participated in dual enrollment as shown in Table 4.

Table 4

Student Sex – Dual Enrollment Participation Prior to Propensity Scoring

		Dual Enrollment		
		No	Yes	Total
Student Sex	Female	3,171	962	4,133
	Male	2,981	664	3,645
Total		6,152	1626	7,778

After the execution of the propensity score matching model, the demographic characteristics of the 2010 cohort subsample were analyzed. The subsample comprised of 3,252 paired students. Of those students, 1,955 (60.11%) were reported as female and 1,297 (39.88%) male. Of these, 1,626 (50%) participated in dual enrollment as shown in Table 5.

Table 5

Student Sex – Dual Enrollment Participation Propensity Scored

		Dual Enrollment		
		No	Yes	Total
Student Sex	Female	993	962	1,955
	Male	633	664	1,297
Total		1,626	1,626	3,252

High school GPA. Of the original student sample of 7,778, those who participated in dual enrollment (n = 1,626, 20.91%) had a mean high school grade point average of $\bar{x} = 3.61$. The 6,152 (79.09%) students who did not participate in dual enrollment had a mean high school grade point average of $\bar{x} = 3.01$ as shown in Table 6.

Table 6

High School GPA Prior to Propensity Scoring

Dual Enrollment	Mean	n	Std. Deviation
No	3.01	6,152	1.03
Yes	3.61	1,626	0.37
Total	3.60	7,778	0.96

After the execution of the propensity score matching model, the demographic characteristics of the 2010 cohort subsample were analyzed. The subsample comprised of 3,252 paired students. Of those students, 1,626 (50%) participated in dual enrollment and had a mean high school grade point average of $\bar{x} = 3.61$. The 1,626 (50%) students who did not participate in dual enrollment had a mean high school grade point average of $\bar{x} = 3.58$ as shown in Table 7.

Table 7

High School GPA Propensity Scored

Dual Enrollment	Mean	n	Std. Deviation
No	3.58	1,626	0.42
Yes	3.61	1,626	0.37
Total	3.60	3,252	0.40

Pell Eligibility. Of the total sample students, 3,938 (50.63%) were Pell eligible, and 606 (15.39%) of the Pell eligible students participated in dual enrollment. Of the 3,840 (49.37%) students who were not Pell eligible, 1,020 (26.57%) participated in dual enrollment as shown in Table 8.

Table 8

Pell Eligibility Prior to Propensity Scoring

		Dual Enrollment		
		No	Yes	Total
Pell	No	2,820	1,020	3,840
Eligible	Yes	3,332	606	3,938
Total		6,152	1,626	7,778

After the execution of the propensity score matching model, the demographic characteristics of the 2010 cohort subsample were analyzed. The subsample comprised of 3,252 paired students (n = 3,252). Of those students, 1,173 (36.07%) were Pell eligible, and 606 (51.66%) Pell eligible students participated in dual enrollment. Of the 2,079 (63.93%) students who were not Pell eligible, 1,020 (49.06%) participated in dual enrollment as shown in Table 9.

Table 9

Pell Eligibility Propensity Scored

		Dual Enrollment		
		No	Yes	Total
Pell	No	1,059	1,020	2,079
Eligible	Yes	567	606	1,173
Total		1,626	1,626	3,252

Minority Status. Of the sample students, 634 (8.13%) held minority status, and 85 (13.45%) of minorities participated in dual enrollment. Of the 7,077 (90.99%) students who were not of minority status, 1,537 (21.72%) participated in dual enrollment as shown in Table 10.

Table 10

Minority Status Prior to Propensity Scoring

		Dual Enrollment		
		No	Yes	Total
Minority	No	5,540	1,537	7,077
Status	Yes	547	85	634
Total		6,152	1,626	7,778

After the execution of the propensity score matching model, the demographic

characteristics of the 2010 cohort subsample were analyzed. The subsample comprised of 3,252

paired students. Of those students, 162 (4.98%) held minority status, and 85 of all minority

students (52.47%) participated in dual enrollment. Of the 3,081 (94.74%) students who were not

of minority status, 1,537 (49.89%) participated in dual enrollment as shown in Table 11.

Table 11

Minority Status Propensity Scored

		Dual Enrollment		
		No	Yes	Total
Minority	Not Minority	1,544	1,537	3,081
Status	Minority	77	85	162
Total		1,626	1,626	3,252

Rurality. Of the sample students, 2,746 (35.30%) were from non-metro counties, i.e.

rural counties, and 602 (21.92%) participated in dual enrollment. Of the 5,032 (64.70%) students

who were from a metro county, i.e. not rural, 1,024 (20.35%) participated in dual enrollment as

shown in Table 12.

Table 12

Rural Status Prior to Propensity Scoring

		Dual Enrollment		
		No	Yes	Total
Rural Status County of	Nonmetro	2,144	602	2,746
Residence	Metro	4,008	1,024	5,032
Total		6,152	1,626	7,778

After the execution of the propensity score matching model, the demographic

characteristics of the 2010 cohort subsample was analyzed. The subsample comprised of 3,252

paired students (n = 3,252). Of those students, 1,199 (36.87%) were from non-metro, rural

counties, and 602 (50.21%) participated in dual enrollment. Of the 2,053 (63.13%) students who

were from metro non-rural counties, 1,024 (49.89%) participated in dual enrollment as shown in

Table 13.

Table 13

Rural Status Propensity Scored

		Dual Enrollment		
		No	Yes	Total
Rural Status County of	Nonmetro	597	602	1,199
Residence	Metro	1,029	1,024	2,053
Total		1,626	1,626	3,252

Persistence. Persistence is defined as enrolling in the second fall semester following Fall

2010 or enrolling in a West Virginia public postsecondary baccalaureate institution in Fall 2011.

Of the sample students, 2,096 (26.95%) did not persist into the second fall semester, and 211

(10.07%) participated in dual enrollment. Of the students, 5,682 (73.05%) persisted, and 1,415

(24.90%) participated in dual enrollment as shown in Table 14. The mean number of hours

accumulated by termination of Fall 2011--the second consecutive fall semester--for the sample is

$\bar{x} = 39.95$ hours. Dual enrollment students accumulated a mean of $\bar{x} = 45.88$ hours, while

nondual enrolled students accumulated a mean of $\bar{x} = 37.98$ hours as shown in Table 15.

Table 14

Persistence Prior to Propensity Scoring

		Dual Enrollment		
		No	Yes	Total
Persistence	No	1,885	211	2,096
	Yes	4,267	1,415	5,682
Total		6,152	1,626	7,778

Table 15

Mean Persistence Prior to Propensity Scoring

Dual Enrollment		Mean Hours	n	Std. Deviation
	No	37.98	4,267	13.93
	Yes	45.88	1,415	12.38
Total		39.95	5,682	13.99

After the execution of the propensity score matching model, the outcome characteristics

of the 2010 cohort subsample was analyzed. The subsample comprised of 3,252 paired students

(n = 3,252). Of those students, 478 (14.70%) did not persist, and of those students, 211 (44.14%)

participated in dual enrollment. Of the 2,774 (85.30%) students who persisted, 1,415 (51.01%)

participated in dual enrollment as shown in Table 16. The mean number of hours accumulated by termination of Fall 2011, the second consecutive fall semester, for the subsample is $\bar{x} = 44.26$ hours. Dual enrollment students in the subsample accumulated a mean of $\bar{x} = 45.88$ hours, while non dual enrolled students accumulated a mean of $\bar{x} = 42.58$ hours as shown in Table 17.

Table 16

Persistence Propensity Scored

		Dual Enrollment		
		No	Yes	Total
Persistence	No	267	211	478
	Yes	1,359	1,415	2,774
Total		1,626	1,626	3,252

Table 17

Mean Persistence Propensity Scored

Dual Enrollment	Mean	n	Std. Deviation
No	42.58	1,359	12.17
Yes	45.88	1,415	12.38
Total	44.26	2,774	12.39

Graduation. Of the sample students, 4,217 (54.22%) did not graduate with a bachelor degree within six-years, and 535 (12.69%) participated in dual enrollment. Of the 3,561 (45.78%) students graduated, and 1,091 (30.64%) participated in dual enrollment as shown in Table 18.

Table 18

Graduation Status Prior to Propensity Scoring

		Dual Enrollment		
		No	Yes	Total
Graduation Status	No	3,682	535	4,217
	Yes	2,470	1,091	3,561
Total		6,152	1,626	7,778

After the execution of the propensity score matching model, the outcome characteristics of the 2010 cohort subsample were analyzed. The subsample comprised of 3,252 paired students (n = 3,252). Of those students, 1,192 (36.65%) did not graduate, and of those students, 535 (44.88%) participated in dual enrollment. Of the 2,060 (63.35%) students who graduated within six-years, 1,091 (52.96%) participated in dual enrollment as shown in Table 19.

Table 19

Graduation Status Propensity Scored

		Dual Enrollment		
		No	Yes	Total
Graduation Status	No	657	535	1,192
	Yes	969	1,091	2,060
Total		1,626	1,626	3,252

Research Question One

The research question posed, whether there is a significant effect on persistence and graduation in West Virginia public baccalaureate postsecondary schools from students who complete dual credit courses. This effect was examined via chi-square testing.

Persistence. After the grouping process using propensity score matching, chi-square

testing was utilized to determine the presence of a significant relationship between persistence in

West Virginia public baccalaureate postsecondary schools and participation in dual enrollment.

Persistence, the dependent variable, was operationalized as the completion of the fall semester of

2011, the semester following the first full academic year, and was treated as a dichotomous

variable. Dual enrollment status, the independent variable, is dichotomous.

Table 20

Chi-Square – RQ 1 Persistence/Dual Enrollment

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	7.691[a]	1	.006		
Continuity Correction[b]	7.419	1	.006		
Likelihood Ratio	7.706	1	.006		
Fisher's Exact Test				.006	.003
Linear-by-Linear Association	7.689	1	.006		
N of Valid Cases	3,252				

Note. A. 0 cells (.0%) have expected count less than 5. The minimum expected count is 239.00. b.

Computed only for a 2x2 table

Table 21

Symmetric Measures – RQ 1 Persistence/Dual Enrollment

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	0.049	0.017	2.776	.006[c]
Ordinal by Ordinal	Spearman Correlation	0.049	0.017	2.776	.006[c]
N of Valid Cases		3,252			

Note. A. Not assuming the null hypothesis. B. Using the asymptotic standard error assuming the null hypothesis. C. Based on normal approximation.

The relationship was found to be significant between the variables χ^2 (1, n = 3,252) = 7.70, p < .05. As demonstrated in Tables 20 and 21, the relationship is significant at the p= .006 level, however, the correlation is not very strong at .05. The coefficient of determination (e.g. explained variability) is 0.0025.

Table 22

Distribution – Persistence/Dual Enrollment

		Persistence		
		No	Yes	Total
Dual	No	267	1,359	1,626
Enrollment	Yes	211	1,415	1,626
Total		478	2,774	3,252

       The odds ratio was calculated by dividing the number of dual enrollment students who persisted (n=1,415) by those who did not (n=211) and also by dividing nondual enrollment students who persisted (n=1,359) by those who did not (n=267). See Table 22. These totals were then divided to determine the odds of dual enrollment student persisting versus a nondual enrollment student persisting. The odds ratio = (1415/211) / (1359/267) = 1.39 which indicates that a dual enrolled student is 1.39 times more likely to persist through the second Fall semester than a nondual enrolled student.

       A post-hoc t-test, Levene's Test for equality of means, was then conducted to determine if dual enrolled students completed significantly more credits by the end of the second fall semester than nondual enrolled students as demonstrated in Tables 23 and 24.

Table 23

T-test Distribution – Fall 2011 Accumulated Hours/Dual Enrollment

Dual Enrollment	n	Mean	Std. Deviation	Std. Error Mean
No	1,359	42.575	12.173	0.330
Yes	1,415	45.884	12.384	0.329

Table 24

Independent Samples Test – Fall 2011 Accumulated Hours/Dual Enrollment

		Levene's Test		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Fall 2011 Hours	Equal variances assumed	0.124	.725	-7.094	2,772	.001	-3.309	0.466	-4.224	-2.394
	Equal variances not assumed			-7.097	2,770.506	.001	-3.309	0.466	-4.223	-2.395

Results indicate that dual enrollment students completed significantly more credits over nondual enrollment students (M = -3.31, SD = .47), t (2772) = -7.09, p < .05, see Table 24. Equal variances are assumed as we do not reject the null of the Levene's test as p > .05. Those students who were enrolled in dual enrollment courses completed significantly more credits by the end of the fall semester of the second year than those who did not. On average, the dual enrollment students completed 45.88 (sd = 12.38) credits in comparison to 42.58 (sd = 12.17) completed by nondual enrollment students.

Graduation. After the grouping process using propensity score matching, chi-square testing was utilized to determine the presence of a significant relationship between graduation from West Virginia public baccalaureate postsecondary schools from students who complete dual credit courses. Graduation, the dependent variable, was operationalized as a dichotomous variable, receipt of a baccalaureate degree within six-years. Dual enrollment status, the independent variable, is dichotomous.

Table 25

Chi-Square – RQ 1 Graduation/Dual Enrollment

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	19.712[a]	1	.001		
Continuity Correction[b]	19.390	1	.001		
Likelihood Ratio	19.738	1	.001		
Fisher's Exact Test				.001	.001
Linear-by-Linear Association	19.706	1	.001		
N of Valid Cases	3,252				

Note. a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 596.00. b. Computed only for a 2x2 table

Table 26

Symmetric Measures – RQ 1 Graduation/Dual Enrollment

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	0.078	0.017	4.452	.001[c]
Ordinal by Ordinal	Spearman Correlation	0.078	0.017	4.452	.001[c]
N of Valid Cases		3,252			

Note. a. Not assuming the null hypothesis. b. Using the asymptotic standard error assuming the null hypothesis. c. Based on normal approximation.

The relationship between the graduation and participation in dual enrollment was found to be significant χ^2 (1, n = 3,252) = 19.71, p <.05. As demonstrated in Tables 25 and 26, the relationship is significant at the p = .001 level, however, the correlation is strong at 0.8. The coefficient of determination (e.g. explained variability) is 0.064.

Table 27

Distribution – RQ 1Graduation/Dual Enrollment

		Dual Enrollment		
		No	Yes	Total
Graduation	No	657	535	1,192
	Yes	969	1,091	2,060
Total		1,626	1,626	3,252

The odds ratio was calculated by dividing the number of dual enrollment students who graduated (n=1,091) by those who did not (n=969) and also by dividing nondual enrollment students who graduated (n=535) by those who did not (n=657). See Table 27. These totals were then divided to determine the odds of dual enrollment student graduating verses a nondual enrollment student graduating. The odds ratio = (1,091/969) / (535/657) = 1.4 which indicates that a dual enrolled student 1.4 times more likely to graduate within six-years than a nondual enrolled student.

A post-hoc t-test, Levene's Test for equality of means, was then conducted to determine if by looking at differences in second fall credit accumulation for graduates versus non-graduates in the dual enrollment group and second fall credit accumulation in graduates and non-graduates for the non-dual enrollment, if persistence and dual enrollment influenced graduation as shown in Tables 28 and 29.

Table 28

T-test Distribution – RQ 1 Dual Enrollment/ Fall 2011 Hours/Graduation

Dual Enrollment	Graduation	N	Mean	Std. Deviation	Std. Error Mean
No Fall 2011 Hours	No	406	34.320	13.069	0.649
	Yes	953	46.092	9.862	0.320
Yes Fall 2011 Hours	No	340	39.812	14.049	0.762
	Yes	1,075	47.805	11.146	0.340

Table 29

Independent Samples Test – RQ 1 Dual Enrollment/Fall 2011Hours/Graduation

Graduation			Levene's Test		t-test for Equality of Means						95% Confidence Interval of the Difference	
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference		Lower	Upper
No	Fall 2011 Hours	Equal variances assumed	83.07	.001	-18.19	1357	.001	-11.77	0.647		-13.04	-10.50
		Equal variances not assumed			-16.28	610.07	.001	-11.77	0.723		-13.19	-10.35
Yes	Fall 2011 Hours	Equal variances assumed	45.23	.001	-10.79	1413	.001	-7.99	0.741		-9.45	-6.54
		Equal variances not assumed			-9.58	481.39	.001	-7.99	0.834		-9.63	-6.35

Results indicate that those who took dual enrollment courses who graduated completed significantly more credits by the end of the fall semester of the second year than those who did not – t (481.39) = -9.58, p < .05. See Table 29. In addition, the dual enrollment graduates completed 47.81 (sd = 11.15) credits in comparison to 39.81 (sd = 14.05) completed by non-graduates. Correction was applied to account for inequality of group variances. Equal variances are not assumed, as we reject the null of the Levene's test as p < .05.

Research Question Two

The research question pursued after the grouping process was whether there is a significant effect on the persistence and graduation of dual credit students in West Virginia public baccalaureate postsecondary schools based on the following student characteristics: socioeconomic status (Pell eligible, not eligible); sex (male, female); college readiness (high school grade point average), rurality (West Virginia metro county, West Virginia nonmetro county), and minority status (White, other race/ethnicity).

Persistence. The effect on the persistence of dual credit students based on certain predictor variables in West Virginia public baccalaureate postsecondary was determined using a logistic regression after the propensity score grouping. The variables were socioeconomic status, sex, college readiness, rurality, and minority status.

Table 30

RQ 2 Persistence Omnibus Tests of Model Coefficients

	Chi-square	df	Sig.
Step	239.368	6	.001
Block	239.368	6	.001
Model	239.368	6	.001

Table 31

RQ 2 Persistence Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	2,475.70[a]	0.071	0.125

Note. a. Estimation terminated at iteration number 5 because parameter

estimates changed by less than 0.001.

Table 32

RQ 2 Persistence Classification Table

			Predicted		
			Persistence		Percentage
	Observed		No	Yes	Correct
Step 1	Persistence	No	21	457	4.4
		Yes	26	2748	99.1
	Overall Percentage				85.1

Note. a. The cut value is 0.500

Table 33

RQ 2 Persistence Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)
Rurality	0.356	0.105	11.528	1	.001	1.428
College Redness	1.687	0.123	187.582	1	.001	5.402
Dual Enrollment	0.217	0.104	4.317	1	.038	1.242
Sex	0.133	0.108	1.510	1	.219	1.142
Minority Status	-0.035	0.214	0.027	1	.870	0.965
Socioeconomic Status	-0.335	0.106	9.914	1	.002	0.715
Constant	-4.386	0.442	98.393	1	.001	0.012

The overall regression model is significant χ^2 (6) = 239.37, p<.05, See table 30. The predictors combined explain a significant portion of variability in the dependent variable, i.e. persistence. Nagelkerke's R^2 of 0.125 indicated a weak relationship between prediction and grouping, see Table 31. Prediction success overall was 85.1% (99.1% for persistence and 4.4% did not persist), see Table 32. The Wald criterion (Table 33) demonstrated that Rurality is significant at $p < .05$, the B coefficient is 0.36, odds ratio 1.43; College Readiness is significant at $p < .05$, the B coefficient is 1.7, odds ratio 5.4; Dual enrollment is significant at $p < .05$, the B coefficient is 0.22, odds ratio 1.24; Sex is not significant at $p > .05$, the B coefficient is 0.13; Minority Status is not significant at $p > .05$, the B coefficient is -0.04; Socioeconomic Status is significant at $p < .05$, the B coefficient is -0.34, odds ratio 0.72.

Graduation. The effect on the graduation of dual credit students based on certain predictor variables in West Virginia public baccalaureate postsecondary was determined using a

logistic regression. The variables were, socioeconomic status, sex, college readiness, rurality, and minority status.

Table 34

RQ 2 Graduation Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	474.731	6	.001
	Block	474.731	6	.001
	Model	474.731	6	.001

Table 35

RQ 2 Graduation Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	3,798.986[a]	0.136	0.186

Note. a. Estimation terminated at iteration number 4 because parameter estimates changed by less than 0.001.

Table 36

RQ 2 Graduation Classification Table

			Predicted		
			Graduation		Percentage
Observed			No	Yes	Correct
Step 1	Graduation	No	494	698	41.4
		Yes	253	1,807	87.7
	Overall Percentage				70.8

Note. a. The cut value is 0.500

Table 37

RQ 2 Graduation Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)
Rurality	0.273	0.081	11.345	1	.001	1.314
College Readiness	1.959	0.108	329.951	1	.001	7.091
Dual Enrollment	0.310	0.079	15.482	1	.001	1.363
Sex	0.015	0.081	0.032	1	.857	1.015
Minority Status	-0.223	0.162	1.895	1	.169	0.800
Socioeconomic Status	-0.465	0.082	32.261	1	.001	0.628
Constant	-6.591	0.397	275.026	1	.001	0.001

The overall regression model is significant χ^2 (6) = 474.73, p<.05, see Table 34. The predictors combined explain a significant portion of variability in the dependent variable, i.e. graduation. Nagelkerke's R^2 of 0.19 indicated a weak relationship between prediction and

grouping, see Table 35. Prediction success overall was 70.8% (87.7% for graduation and 41.4% did not graduate), see Table 36. The Wald criterion (see Table 37) demonstrated that Rurality is significant at $p < .05$, the B coefficient is 0.27, odds ratio 1.31; College Readiness is significant at $p < .05$, the B coefficient is 1.96, odds ratio 7.09; Dual enrollment is significant at $p < .05$, the B coefficient is 0.31, odds ratio 1.36; Sex is not significant at $p > .05$, the B coefficient is 0.02; Minority Status is not significant at $p > .05$, the B coefficient is -0.22; Socioeconomic Status is significant at $p < .05$, the B coefficient is -0.47, odds ratio 0.63.

SUMMARY

Propensity score matching was utilized to create groups closest to each other based on characteristics that literature suggests are associated with the main dependent variables examined here: postsecondary retention and graduation. The propensity scores were created using the variables of Pell eligibility (i.e. socioeconomic status), college readiness (i.e. college grade point average), sex, rurality, and minority status. The use of propensity score matching also minimizes the risk of outliers as the groups are paired based on the score derived from these variables. The matched groups were then used to carry out the testing required to satisfy the research questions.

As hypothesized, research question one indicated significant results for both persistence and graduation for West Virginia public baccalaureate dual enrollment students. Chi – square testing showed a significant relationship ($p < .05$) between persistence and dual enrollment. A post-hoc t-test determined that dual enrollment students completed significantly ($p < .05$) more credits through the end of the second fall term, $\bar{x} = 45.88$ compared to $\bar{x} = 42.58$ nondual enrolled students. For graduation, chi – square testing showed a significant relationship ($p < .05$) between dual enrollment and graduation. Significant results ($p < .05$) were then found within the

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dual enrollment subsample when looking at the number of hours accumulated by the second fall semester and graduation through the utilization of a t-test post-hoc.

In research question 2, logistic regressions found significant results on the effect of certain variables on persistence and graduation as hypothesized, but not for others. The models for both persistence and graduation were statistically significant at the $p < .01$ level. Among the characteristics examined, rurality, college readiness, dual enrollment, and socioeconomic status of the subsample--both persistence and graduation showed a significant relationship at the $p < .05$ level. These relationships were stronger for dual enrollment and socioeconomic status ($p < .01$) for graduation than persistence ($p < .05$). Neither sex nor minority status showed a significant relationship for either persistence or graduation.

CHAPTER 5

SUMMARY, DISCUSSION AND RECOMMENDATION

The following pages provide an overview of the study's findings and relevance, describe how the findings align with or dissociate from similar studies, postulate who may benefit from the study, and offer recommendations for further research. The study evaluated the outcomes associated with dual enrollment in West Virginia in order to inform educational strategy and policy development. By determining the effectiveness of dual enrollment programs in West Virginia with regard to postsecondary access and success, policymakers and educators may gain a better understanding of the dual enrollment's influence on not only the public student population as a whole, but also in considering vulnerable populations less likely to enroll or complete postsecondary baccalaureate education.

As the data available in regard to the effectiveness of dual enrollment credits are limited at both national and state levels, this study provides an analysis of the outcomes of the program in West Virginia for the 2010 first-time, full-time, in-state, public four-year postsecondary cohort. Dual enrollment programs vary across states which contributes to the difficulty comparing programs (Allen, 2010). However, the results of this study indicate that dual enrollment credits for West Virginia students have a significant relationship to persistence in and graduation from public West Virginia baccalaureate postsecondary institutions.

This study also considered vulnerable populations in order to determine program effectiveness for underrepresented students who often struggle with postsecondary access and completion. When these attributes and characteristics were considered, significant relationships were found among most of the variables tested. It is important to note that of the hypothesized

relationships, sex and minority status were not found to be significant for either persistence or graduation.

Findings

The longitudinal data for this study cover a six-year time period from the 2010 – 11 academic year to 2015 -16. According to the HEPC & CTC (2011), the total first-time freshmen enrolled in West Virginia public four-year postsecondary schools was 11,697, and of those students, 7,778 met the requirements for inclusion in this study (i.e. in-state). As indicated by the dataset, 1,626 of these students possessed at least one credit hour of dual enrollment. Propensity score matching was utilized to address unequal comparison groups by assigning pairs using closest propensity scores. This analysis created two comparison groups as a subset consisting of 3,252 students (i.e. 1,626 students who were dually enrolled and 1,626 who were not). These propensity matched pairs were then used to address the following research questions using chi-square, logistic regression, and further t-test analysis.

The first research question posed was whether there is a significant effect on persistence and graduation in West Virginia public baccalaureate postsecondary schools from students who complete dual credit courses. The second, was whether there is a significant effect on the persistence and graduation of dual credit students in West Virginia public baccalaureate postsecondary schools based on the following student characteristics: socioeconomic status (Pell eligible, not eligible); sex (male, female); college readiness (high school grade point average), rurality (West Virginia metro county, West Virginia nonmetro county), and minority status (White, other race/ethnicity).

As hypothesized, research question one indicated significant results, $p < .05$, for both persistence and graduation for West Virginia public baccalaureate dual enrollment students. A t-

test further determined that even when excluding dual enrollment credit earned, the students completed more credits through the end of the second fall term, compared to nondual enrolled students (M = 45.88 v. M = 42.58, respectively). An additional t-test determined a positive difference in second fall credit accumulation for graduates versus non-graduates in the dual enrollment group and second fall credit accumulation in graduates and non-graduates for the non-dual enrollment. Persistence and dual enrollment significantly influenced graduation, i.e. $p < .05$.

For question two, a significant effect exists among certain variables on persistence and graduation model as hypothesized, but not for others. Both persistence and graduation models were significant at the $p < .01$ level. Among the same characteristics used for the model (i.e. rurality, college readiness, dual enrollment, and socioeconomic status) significance existed at the $p < .05$ level. A stronger significance for dual enrollment and socioeconomic status was determined at the $p < .01$ for graduation as opposed to persistence which was still significant at the $p < .05$ level. Neither sex nor minority status showed a significance for either persistence or graduation. This is a departure from the initially hypothesized findings.

Discussion

The following discussion outlines the significance of the research outcomes along with findings from other relevant studies. The section is organized into four subsections, with each research question addressed in relation to persistence and graduation. Subsequently, these sections are titled, RQ1 Persistence and RQ1 Graduation for research question one, and RQ2 Persistence and RQ2 Graduation for research question two.

RQ1 Persistence. The significant relationship, $p = .006$, determined among persistence and dual enrollment for research question one did not indicate a strong correlation at .05. The

goodness of fit, $R^2 = .0025$, indicates that there is a connection, but not very strong between persistence and dual enrollment. This finding is in line with the hypothesis and also with two studies outlined by the United States Department of Education, Institute of Education Sciences (2017) *What Works Clearinghouse* meta-analysis study. Of both studies cited in the meta-analysis related to credit accumulation, positive effects were estimated to have medium to large influence, while this study indicated a relatively small effect. This is further substantiated by the study as it indicates an improvement of 14 percentile points on average when using the improvement index established by the Clearinghouse. The analysis further purported that credit accumulation was positive in both studies and that no study produced negative effects.

While persistence was not explored by either study used by the Clearinghouse, per se, credit accumulation is best translated into the findings of the t-test used in this study showing that that dual enrollment students completed more credits through the end of the second fall term. In Swanson (2008), however, a logistic regression determined statistically significant effects on persistence, i.e. through the second year of college. According to Swanson, dual enrollment credits create a "nest-egg effect" which influences student academic momentum (2008, p.3). Students who complete more credits are more likely to graduate according to a study conducted by the Education Advisory Board using approximately 1.3 million freshmen from 137 colleges and universities. The cohort was comprised of all full-time freshmen who started college between summer 2011 and spring 2016 semesters (Venit, 2017). These findings along with the findings of this research indicate that in-state students who complete dual enrollment courses are more likely to persist past their first academic year in West Virginia public institutions when compared to their nondual enrollment counterparts. These dually enrolled students accumulate

three more credits on average as well, thus, the accumulation of hours has shown to improve the likelihood of graduation which is further explored in research question one.

As there is a relationship among dual enrollment and persistence into the second fall semester, it is important to understand that students appear more likely to persist when they participate in dual enrollment programs. On average, first-time freshmen complete 12 to 14 credit hours per term in the first year, which puts them behind from finishing within four-years (Venit, 2017). The longer a student takes to complete a degree, the more expense incurred by students, increasing the likelihood of debt through student loans. Promoting dual enrollment participation not only allows the student to bank hours prior to enrolling in their first full semester, but according to this research, the student is more likely to accumulate three additional hours on average when compared to the nondual enrolled peer. These three hours do not include the hours obtained as dual credit, and indicate an accumulation of 15.29 hours per semester by the end of the second fall semester $M = 45.88$. According to HEPC & CTC 2016 Report Card (2017), West Virginia ranks last among the 16 SREB states in first year overall persistence. Based on the findings, increased opportunity for more students to complete dual enrollment may positively influence overall postsecondary persistence in the state.

RQ1 Graduation. A significant relationship, $p = .001$, was found among graduation and dual enrollment. The correlation was moderately strong at .8 while the coefficient of determination was somewhat strong at .64. The odds ratio indicates that dual enrolled students are 1.4 times more likely to graduate within six-year when compared to the nondual enrolled student. As hypothesized, a relationship exists among these variables. These findings indicate that dual enrolled in-state students in West Virginia public postsecondary baccalaureate institutions are more likely to graduate than their counterparts. Again, these findings are

supported by the *What Works Clearinghouse* meta-analysis that identified positive effects of dual enrollment on graduation with medium to large evidence (U. S. Department of Education, 2017). The meta-analysis included five studies and calculated an average of 25 percentile points on their improvement index. Further, of the five studies used in the analysis, none showed substantive negative effects.

Both An (2013) and Swanson (2008) support significant findings among dual enrollment and graduation using NELS data. In addition, Swanson (2008) reported that students who earned at least 20 credits by the end of the freshman year were more likely to graduate. Swanson's dual enrollment findings are relevant as this research found a significance between the total number of hours accumulated by the second fall semester and graduation. This supports the research available regarding the positive influence dual enrollment has on graduation, but does so importantly at the West Virginia level.

Dual enrollment was associated with higher chances of graduation as the credit accumulation by the second fall semester indicates that there are significant differences in credit accumulation between graduates and non-graduates when comparing groups. Even though dual-enrolled students get a head start before postsecondary enrollment, their progression in college also makes a difference for degree completion as shown when only considering that subsample. Further, the dual enrollment graduates accumulated at least 15 credit hours per semester on average as advised by the popular *15 to Finish*, a *Complete College America* and current West Virginia initiative (Venit, 2017).

West Virginia reported a 46.3% six-year graduation rate for students seeking a bachelor's degree in 2007 as compared to the national percentage of 57.7, almost 10% below the average (HEPC & CTC, 2017). According to the same most recent data, despite a percentage increase to

48.2% in 2010, West Virginia remained well below the 2007 national graduation average. Increased access to dual enrollment in West Virginia could assist in increasing the six-year rate, as 67.1% of dual enrollment students in the subsample graduated within six years in this study.

RQ2 Persistence. The effect on the persistence of dual credit students based on socioeconomic status, sex, college readiness, rurality, and minority status in West Virginia public baccalaureate postsecondary schools indicated a significant ($p = .001$) model in considering the influences of all predictor variables. Independently, rurality and college readiness were also significant at $p = .001$ with a 1.43 odds ratio for rurality, and 5.40 odds ratio for college readiness. This indicates that the odds of students who were not from rural counties were 1.43 times more likely to persist, while those who were college ready were 5.4 times more likely. Socioeconomic status was significant at the $p = .002$ level and the odds ratio was 0.72 meaning that those with a lower status were 0.72 times less likely to persist. Dual enrollment was significant at $p = .04$ with an odds ratio of 1.24, meaning that dual enrollment students were 1.24 times more likely to persist as opposed to their counterparts. These findings are somewhat at odds with Swanson (2008) as she indicated that demographic descriptors did not offer many significant results in regard to postsecondary success.

It is noteworthy to mention that minority status and sex did not yield significant results regarding persistence in this research. There were few minorities in the study, 162 out of 3,252 participants (4.98%), which could account for outcome, however in regard to sex, the numbers are more evenly distributed; there were 1,955 female participants making up 60% of the subsample and 1,297 (i.e. 40%) male.

These findings indicate that for the most part, demographics commonly identified as barriers for postsecondary success, i.e. rurality, college readiness, and socioeconomic status are

also identified as significant in this research. However, it was expected that sex and minority status would also be significant in considering persistence. As noted, this expectation was not supported by the study's findings.

As dual enrollment students were 1.24 times more likely to persist as opposed to their counterparts in this study, it makes sense to advocate for additional access to dual enrollment opportunity. Further, as lower socioeconomic students were .72 times less likely to persist, low cost or no cost access to dual enrollment credits could improve West Virginia persistence rates.

RQ2 Graduation. The effect on the graduation of dual credit students based on socioeconomic status, sex, college readiness, rurality, and minority status in West Virginia public baccalaureate postsecondary schools indicate a significant (p = .001) model in considering the influence of all predictor variables. Independently, of all significant variables, i.e. rurality, college readiness, dual enrollment, and socioeconomic status were all significant at p = .001. For rurality an odds ratio of 1.31 was reported, and 7.09 odds ratio for college readiness. This indicates that the odds of students who were not from rural counties were 1.31 times more likely to graduate, while those who were more college ready are 7.09 times more likely. Dual enrollment had an odds ratio of 1.36, meaning that dual enrollment students were 1.36 times more likely to graduate as opposed to their counterparts. Finally, socioeconomic status had an odds ratio of .63 meaning that those with a lower status were .63 times less likely to graduate. These findings are again somewhat at odds with Swanson (2008) as she indicated that demographic descriptors did not offer many significant results in regard to postsecondary success. It is noteworthy to mention that again, minority status and sex did not yield significant results regarding graduation in this research.

These findings indicate that for the most part, demographics commonly identified as barriers for postsecondary success, i.e. rurality, college readiness, and socioeconomic status are also identified as significant in this research. It was anticipated that sex and minority status would be significant in considering graduation, but, again, the data did not support this assumption.

One should note that in West Virginia, 38.7% of low income students and 36% of minorities graduated within six-years in 2010 (HEPC & CTC, 2017). As dual enrollment students were 1.36 times more likely to graduate as opposed to their counterparts in this study, it makes sense to advocate for additional access to dual enrollment opportunity. Further, as lower socioeconomic students were .63 times less likely to graduate, low cost or no cost access to dual enrollment credits could improve West Virginia graduation rates. Of additional interest are the significant t-test results that indicated that dual enrollment significantly influenced persistence and graduation without considering the total number of hours accumulated as dual enrollment credit.

Recommendations

The study's outcomes underscore the importance and benefit derived from dual enrollment on both persistence and graduation for in-state students in West Virginia public postsecondary baccalaureate institutions. Although the total number of dual-enrollment West Virginia students is on the rise, 53.7% increase from 2011 to 2015, only a small number of students actually participate in the program, 3,445 statewide in 2015 (HEPC & CTC, 2017). In considering the demographic representation of students in the study's sample, the number of students who were Pell eligible who participated in dual enrollment totaled 606, which represents 37% of the total number of students who had dual enrollment credits. It is important to note here

that from the same sample of in-state, first-time, full-time, students enrolled in West Virginia public postsecondary baccalaureate schools in 2010, a majority of the students, 51%, were Pell eligible.

The first recommendation for increased access to dual enrollment opportunities for West Virginia secondary students, would be through the provision of free courses offering high school and postsecondary credits. Eliminating the participation costs would assist in filling the gap between low income students and dual enrollment participation. Florida, one of the best developed dual enrollment systems, offers free tuition, fees and texts for public school students, while homeschooled must pay for textbooks (Allen, 2010). According to Allen, Florida boasts that the total number of students participating in their program exceeded 37,000. New York also reports positive outcomes as participants were 9.7% more likely to obtain a bachelor degree as opposed to an associate's degree, and also earned credit faster than their counterparts (Karp et al., 2007). From this study, the authors further concluded that dual enrollment can benefit a wide range of participants and outreach should be expanded to the underserved.

Eliminating costs to students for dual credit enrollment will not only increase program participation, it should reduce students' total cost of postsecondary education due to a decrease in time to graduation. In other words, access to dual enrollment courses will increase while overall cost of the postsecondary degree will decrease. This is especially important because the average debt incurred by a West Virginia college graduate increased 70% since 2005 and the state claims the second highest default rate in the country (O'Leary, 2017). Thus, there are strong benefits for the provision of early credit for both the student and institutions whose financial aid awards are affected by loan default rates.

The second recommendation based on this study is the advocacy for increased consistency among counties and institutions of higher education. West Virginia Board of Education Policy 2510 (2016) and Series 19 (2016) fall short on promoting uniformity in statewide dual enrollment provision. Both systems grant significant autonomy in decision making to counties and postsecondary institutions. In light of the these differences and the outcomes in regard to rurality in this study, rural West Virginians could benefit from a more consistent offering of dual enrollment credits, as proximity to institutions of higher education may be less likely. Mandated dual enrollment activity, such as that in Florida which requires that superintendents of schools and presidents from public postsecondary institutions are obligated to have a comprehensive dual enrollment articulation agreement for the respective district and institution, would also benefit the West Virginia (Education Commission of the States, 2016).

The third recommendation is that the West Virginia Higher Education Policy Commission and the West Virginia Board of Education should develop a stronger relationship in regard to the oversight and provision of dual enrollment courses. Agreement between both oversight agencies mandating certain criteria as recommended above would decrease access inequality to students throughout the state. Both in-state and the general college going rate has consistently dropped from 2010 through 2014 in West Virginia (HEPC & CTC, 2017). During the 2013-14 school year, in all counties there was an 18,177 net enrollment of seniors in West Virginia public schools and 17,671 graduates (WVDE, n.d.b). According to the 2015 HEPC and CTC report card, the overall college going rate decreased to 54.6% in the same year. As the *What Works Clearinghouse* identified positive effects of dual enrollment on high school completion and access and enrollment at a medium to large extent of evidence (U. S. Department of Education, 2017), both entities could benefit from stronger collaboration as well as the students

they serve.

Recommendations include the development of a study with a true experimental design. Unfortunately, the design of this study cannot produce inferential data. The inclusion of random assignment would produce more definitive results. It is important to note that careful ethical consideration would be necessary as to not disadvantage one group over another. Additionally, further exploration of minorities and dual enrollment participation in West Virginia is needed. As discussed earlier in this chapter, the low number of minority students who participated in dual enrollment as indicated in the sample of first-time, full-time, freshmen who were enrolled in West Virginia public postsecondary institutions in Fall 2010 may have affected the findings. A qualitative or mixed method study might better report on the outcomes and influence of dual enrollment engagement for minority students. Literature abounds in regard to the influence of certain characteristics such as race on postsecondary access and completion (Kolonder, 2016; National Student Clearinghouse Research Center, 2017; NCES, 2017; Shapiro et al., 2017) but the results of dual enrollment research such as Swanson (2008) and this study do not indicate strong significance when it comes to race and sex.

In addition to the further research proposed, a comparative analysis of types of postsecondary credit bearing programs offered in high school such as dual enrollment, advanced placement, and taking classes on college campuses during senior year, for example, would provide secondary analysis in regard to postsecondary outcome success of other postsecondary acceleration programs offered in the state. This comparison may indicate that certain programs are more effective when considering which method would better prepare students for college success. A major consideration regarding rurality and the effectiveness of these programs is the Higher Learning Commission's requirement that dual enrollment courses must be taught by

instructors with a Master degree in the discipline. This limits dual-enrollment availability in many counties. Therefore, further research could determine if access to college courses using an online learning system or video streaming might prove beneficial for high school students in rural areas.

CONCLUSIONS

The study's findings indicate a significant relationship between dual enrollment and persistence, and also with graduation. These findings also support that among socioeconomic status, college readiness, rurality, sex, and minority status, dual enrollment presents significant models in both persistence and graduation. At the variable level, however, neither sex nor minority status were found significant for persistence or graduation. Further analysis determined that dual enrollment increased the average number of credits earned by the second fall semester by one three credit course on average and further determined that dual enrollment students are more likely to graduate based on the number of credits accumulated in that same semester.

Overall, these findings are supported by other research but are meaningful for the West Virginia secondary and postsecondary systems. From these findings and the characteristics of the state, it is recommended that dual enrollment be made more available by streamlining the system through collaboration by secondary and postsecondary oversight bodies. It is further recommended that the courses be offered free-of-charge to students in order to address income disparity in dual enrollment participation. Further research is merited in order to provide more definitive results using an experimental design and also in understanding the outcomes for dual enrolled minority students using qualitative analysis. Further analysis in regard to the effectiveness of other postsecondary credit earning programs in comparison with others, i.e. advanced placement and CLEP testing, should also be explored in regard to student

characteristics, and postsecondary persistence and graduation in the state. Other methods of delivering postsecondary content to high school students should also be explored in order to address accessibility issues associated with rural communities.

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APPENDIX A

LETTER FROM OFFICE OF RESEARCH INTEGRITY

MARSHALL UNIVERSITY.
www.marshall.edu

Office of Research Integrity

February 6, 2018

Charles S. Inghram
PO Box 1074
Athens, WV 24712

Dear Mr. Inghram:

This letter is in response to the submitted dissertation abstract entitled *"Student Attributes Related to Dual Enrollment and Baccalaureate Degree Outcomes in a Rural State."* After assessing the abstract it has been deemed not to be human subject research and therefore exempt from oversight of the Marshall University Institutional Review Board (IRB). The Code of Federal Regulations (45CFR46) has set forth the criteria utilized in making this determination. Since the study does not involve human subjects as defined in DHHS regulation 45 CFR §46.102(f) it is not considered human subject research. If there are any changes to the abstract you provided then you would need to resubmit that information to the Office of Research Integrity for review and determination.

I appreciate your willingness to submit the abstract for determination. Please feel free to contact the Office of Research Integrity if you have any questions regarding future protocols that may require IRB review.

Sincerely,

Bruce F. Day, ThD, CIP
Director

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APPENDIX B

VITA

CHARLES SCOTT INGHRAM

Education

Doctorate of Education, Higher Education Leadership - Marshall University, South

Charleston, West Virginia (Present)

Master of Social Work - Tulane University, New Orleans, Louisiana (May 2009)

Bachelor of Social Work - Concord University, Athens, West Virginia (December 2004)

Bachelor of Arts, Sociology - Concord College, Athens, West Virginia (May 2003)

Work Experience

January 2014 – Present - Assistant Professor of Social Work, Concord University, Athens, WV

August 2009 – Present - Director of Grants and Contracts/ Director of the Office of Sponsored

Programs, Concord University Research and Development Corporation, Athens, WV

February 2005 – July 2009 - Research Administration, Tulane University, New Orleans, LA

June 2004-January 2005 - Title XIX Waiver Case Manager, SHCMHC, Mullens, WV

Publications

Allen, R. A., and Inghram, C.S. (2017). Concord University policy integration and development

program (CUPID). *Policy Practice in Field Education: Summary Report*. Council on

Social Work Education: Washington D.C.

Nicholson, B., Inghram, C.S., Meadows, P., Saunders, A., & Stadler, C. (2016). The Bubble

Wrapped Student: Are Trigger Warnings Necessary in Higher Education. *Southern*

Council of Educational Administration, *16*, (2). Retrieved from:

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Presentations

October 20, 2017 – Annual Social Work Program Meeting – Dallas, TX (National Presentation)

April 27, 2017 – 2017 Spring CE Conference for Social Workers – Charleston, WV Civic Center

(State Presentation)

November 2015, 56ᵗʰ Southern Regional Council on Education Administration Conference

(Regional Presentation)

Current External Funding

$3,250,000 - Bureau of Children and Families Contract – West Virginia Department of Health

and Human Resources

$1,061,456 – 11/01/17 – 06/30/18 –Title IV-E Social Work Program, West Virginia Department

of Health and Human Resources

$200,712 – 11/01/17 – 06/30/18 – PRIDE Expansion - Title IV-B Training Program, West

Virginia Department of Health and Human Resources

Tuition-based (Estimated AY' 18 Revenue $120,400) – 11/01/17 –Provisional License

Program