2023

The Relationship Between College Credits Earned in a Community College Dual Enrollment Program and First-Year Grade Point Average

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Abstract

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Johnesa Norrese Hodge

MSW, University of Michigan, 2004

BS, University of Michigan, 2000

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Education

Walden University

May 2023

Abstract

The increased number of college credits earned in dual enrollment programs initiated concern by educators, researchers, and policymakers regarding college readiness. However, data are scarce and inconsistent across governing states and community colleges to measure college readiness and dual enrollment's effectiveness. The purpose of this quantitative study examined early college credits earned in general education, career and technical education, college orientation disciplines, and first-year grade point average (GPA) to measure college readiness. Conley's key dimensions of college and career readiness model grounded the study. Archival transcript data were collected from a Michigan community college for 524 former dual enrollment students. Multiple and simple linear regression statistical tests analyzed model fit for early college credits earned in specific disciplines to predict first-term GPA. The overall multiple linear regression model results were not significant with none of the discipline credits contributing change in GPA. A series of simple linear regressions indicated a significant positive relationship between college credits earned in general education and predicted an increase in GPA. College credits earned in general education during dual enrollment are a significant predictor of college readiness measured by GPA. This study contributes to positive social change by informing researchers, educators, and policymakers of metrics used to inform early college curriculum design and policy research for college readiness initiative reform. These initiatives may support educational attainment goals by fostering a seamless transition to college without remediation for many high school students.

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Dedication

This study is dedicated to my family and friends who continued to support and encourage me by giving me the confidence to pursue my doctoral goals. Lastly, this is in honor of my late grandmother, Gladys Facey, who always told me I would be the doctor in the family.

Acknowledgments

First and foremost, I praise God for keeping me uplifted and focused in pursuing my educational goals. My faith and perseverance kept me steadfast in achieving my doctoral aspirations coping with advanced heart failure resulting in a heart transplant in December 2022.

I want to thank my husband, 'Damon Hodge', and son, 'DJ', for tirelessly motivating and keeping me accountable for "our" doctoral journey. Without them reminding me why I started this in the first place and supporting me, this would not be possible.

Thank you to my mom, Barbara Thompson, for believing in me and for giving me the encouragement to fight for my dreams. Thank you to my dad, who kept me grounded and committed by reassuring me that my unwavering belief would get me wherever I wanted to go.

Thanks to Dr. Curtis L. Ivery, my mentor and utmost supporter, who pushed me to greatness when I did not always see it for myself. Lastly, I would like to express gratitude for my committee chair, Dr. Ryan Theroux, and research methodologist, Dr. Eilene Edejer, who provided leadership, expertise, and compassion in guiding me throughout the study.

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Chapter 1: Introduction to the Study

Many U.S. students are ill prepared for college. In 2017, the National Center for Education Statistics reported 65% of entering U.S. community college students required at least one remedial course (Chen et al., 2020; Shapiro et al., 2018). College readiness is defined as the knowledge and skills required to prepare students for rigorous college courses without the need for remedial coursework (Fletcher et al., 2018). The lack of readiness is problematic because first-year students who take remedial courses are more likely to have higher costs and require more time for degree or certificate completion (Valentine et al., 2017). The number of students who enter college requiring remediation encouraged educators and researchers to focus on college readiness reform and policies that lead to college preparedness and success (Tierney & Duncheon, 2015). These stakeholders view college readiness reform strategies as essential in preparing students with the knowledge and skills required for academic rigor in college (Chen, 2016; Shapiro et al., 2018). College readiness implications garnered attention of educators and researchers to focus on college preparedness initiatives and reform improvement.

Dual enrollment programs are college preparedness initiatives that have a cumulative positive influence on early college experiences, but there is limited knowledge on specific contributing factors that advance college readiness. Dual enrollment programs' role in college readiness is to enhance the rigor of the high school curriculum by exposing students to college course content and college-going norms to prepare students for success (An & Taylor, 2015). Although there is information on the correlation between standardized testing, high school transcripts, and high school grade

point average (GPA), there is a gap in knowledge and research on comprehensive factors and incremental quality data measures to inform policy improvement and dual enrollment programs contribution to college readiness (Tobolowsky & Allen, 2016; Zinth & Taylor, 2019). Investigation of early college course-taking patterns in community college dual enrollment programs may clarify how the programs contribute to college readiness (Taylor et al., 2015; Tobolowsky & Allen, 2016a). Understanding the relationship between earning discipline-specific college credits in dual enrollment programs may inform outcome data collection policies and development of quality provisions focused on academic performance in college (Grubb et al., 2017; Morgan et al., 2018). Gaining knowledge on specific college readiness elements for dual enrollment may advance evaluation of student outcomes and dual enrollment program improvement.

Further investigation of the impact of dual enrollment programs is also merited because of recent increases in the number of student participants. According to a recent study, dual enrollment programs are responsible for an estimated 1.2 million high school students taking college credits while in high school (Taylor et al., 2022). Community colleges maintain the largest proportion of high school students taking college courses through dual enrollment program participation (Fink et al., 2017). Dual enrollment programs provide students access to early college credits who would not ordinarily attend due to low academic performance and financial barriers (Nelson & Waltz, 2019). The growth in the number of students participating in dual enrollment programs has caused concern for higher education reform administrators and policymakers, given the large number of students who are not prepared for college (Thomson, 2017). As the number of

dual enrollment students earning college credits continues to increase, stakeholders are focusing on gathering data and examining how early college course experiences promote college readiness and success (Fletcher et al., 2018). Examining specific college readiness and academic performance factors while in dual enrollment are pertinent for program improvement and college success.

Misalignment of secondary and postsecondary curriculum impedes seamless transition to college without remediation and college readiness. The increasing number of high school students who are enrolled in college underprepared for entry-level college courses indicates the need to focus on the misalignment between secondary and postsecondary curriculum to prepare students for college (Tobolowsky & Allen, 2016; Troutman et al., 2018; Wells, 2016). Dual enrollment programs offer college credits in core disciplines such as general education and career and technical subject areas to increase the rigor of high school curriculum in preparation for entry-level college courses (An & Taylor, 2015). Dual enrollment programs must establish clear requirements and a shared understanding of college readiness to prepare students for college enrollment and subsequent success (Bush, 2017; Pretlow & Patteson, 2015). College readiness initiative reform focused on alignment of secondary and postsecondary curriculum in dual enrollment may aid seamless transition to college and subsequent success.

Both high school students and partnering colleges benefit from dual enrollment programs resulting in college enrollment and early college experiences to prepare students for college. Early college courses in dual enrollment programs prepare students for the advanced content of college-level coursework towards completion of a degree

(Arnold et al., 2017). Students who participate in dual enrollment take college credits at reduced tuition or no cost to meet college-entry general education requirements and accelerate their transition to college (Azimzadeh et al., 2015). Partnering community colleges that offer dual enrollment maintain advantages related to institutional performance in enrollment, retention and degree completion (Knox, 2022; Stokdyk et al., 2020). Dual enrollment programs have an overall positive effect on students, though there is a need for understanding of how earning early college credits prepare students for college success (Grubb et al., 2017). In Chapter 2, I further discuss the role of dual enrollment programs in enhancing student outcomes by providing exposure to rigorous course content, faculty expectations, college-going norms, and behaviors.

The increasing number of students completing college credits through dual enrollment programs garnered policymakers' and researchers' attention. These stakeholders want to better understand dual enrollments' role in advancing educational attainment (Thomson, 2017). With approximately 70% of all jobs in the U.S. requiring some form of higher education by 2027, educational attainment and accessibility continue to be a concern for society and the workforce as a whole (Blumenstyk, 2020). Dual enrollment programs support the U.S. community college mission, recruitment efforts, retention rates, and graduation outcomes to achieve institutional benchmarks and goals (Bowers & Foley, 2018; Grubb et al., 2017; Hunter & Wilson, 2019; Jones, 2017). Understanding how to advance college readiness may improve degree completion and college-level skill development required for closing the gap on higher education attainment that leads to gainful employment in the United States (Chen, 2016; Shapiro et

al., 2018). Advancing research and the availability of intermediate student outcomes on dual enrollment programs may inform program improvement and effectiveness in closing the gap on college and workforce readiness.

Most of the research related to dual enrollment programs focuses on accessibility, equity, and college outcomes including degree completion, remediation, and retention (Burns et al., 2018; Fink et al., 2017; Grubb et al., 2017). There is limited knowledge of specific dual enrollment program components such as course-taking patterns and their contribution to college readiness (Morgan et al., 2018). This study may broaden understanding of relevant data collection and use of incremental metrics for community college dual enrollment programs. Additionally, these findings could help policymakers to improve secondary and postsecondary curriculum alignment, which could benefit student academic performance. In Chapter 1, I will provide an overview of the study, including the study background, research problem, purpose, research question (RQ) and hypotheses, theoretical framework, and research scope and potential significance to higher education.

Background

Undergraduate enrollment in U.S. postsecondary education decreased from 17.5 million to 15.9 million in the decade spanning 2009 to 2020, with a projected increase to 17.1 million by 2030 (National Center for Education Statistics, 2022b). Research for first-year undergraduates who attended college during 2003 to 2009 reports 40% for 4-year universities and 68% community college required remedial courses because they were not ready for college-entry courses (Chen, 2016). Undergraduates who take

remedial courses in their first year of college are at higher risk for lower retention, longer time to completion, dropping out without a degree, and a greater financial burden (Valentine et al., 2017). Both colleges and students are negatively affected by remedial education course-taking. Students spend an estimated $1.3 billion per year for remediation credits that do not generate credit towards their degree (Sampson, 2018). Lack of preparedness for college increased time and cost to complete degrees which may hinder student success and positive college outcomes.

Another consideration is the need for high school students to complete degrees to close the workforce's educational attainment gap. With the increase in jobs requiring a college degree and 46.7% of the U.S. population holding an associate's degree or higher, U.S. policymakers and educational leaders continue to focus education reform to advance degree completion and talent development to promote employment (Blumenstyk, 2020; McFarland et al., 2019). The increased need for students to attain college degrees and certificates made college readiness and alignment between high schools and postsecondary institutions a focus for reform initiatives (Conley, 2010a; Karp, 2015; Thomson, 2017). Reform efforts to prepare students both occupationally and academically are important to develop viable skills for success in college and the changing workforce.

College readiness describes both the academic and non-academic skills required to prepare college-going students to succeed in college without the need for remediation (Conley, 2010a). Secondary and postsecondary institutions partner to early college program such as dual enrollment to enhance high school student preparedness for college

academic rigor and entry-level careers (Bush, 2017; Wilson & Lowry, 2017; Witkowsky & Clayton, 2020). High schools and postsecondary institutions use various assessments to measure college readiness. Research indicates that college readiness measures focus on long-term metrics such as cumulative college GPA, college admissions testing, degree completion, grades in high school, high school GPA, and subsequent college enrollment (Edmunds et al., 2020; Morgan et al., 2018; Pierson et al., 2017). The aim of early college programs is to expose students to rigorous college-entry courses and college-going behaviors that prepare them for college success. Therefore, early college programs should adopt incremental measures to evaluate course-taking activity, academic momentum, and college readiness to determine program effectiveness.

Early college programs are a prevalent higher education reform strategy offered by both community colleges and 4-year college universities to provide high school students with college experiences and rigorous college-entry academic course content. In 2022, it was estimated that $1.7 million high school students were taking early college courses with community colleges serving majority of the students (Taylor et al., 2022). Dual and concurrent enrollment programs provide students with academic and non-academic skills at lower costs to prepare them for college success and reduce the need for remediation (Conley, 2010). The increasing number of completed college credits earned by high school students in dual enrollment programs has led to concerns related to equitable access for all students, course content rigor, and the use of empirical data to evaluate program effectiveness and college readiness (Thomson, 2017). Although dual enrollment programs are college readiness reform initiatives to streamline college-entry

and preparedness, there is limited understanding of student academic performance while in the program and curriculum effectiveness.

Dual enrollment programs contribute to high school students' exposure to college and increase their likelihood to attend college and pursue college degrees. Dual enrollment programs' role in college readiness is to provide early college experiences in high school, creating a pathway to college and potential careers while students earn college credits towards a degree (Lile et al., 2018). Still, there is a need for additional research to determine comprehensive measures to evaluate college readiness (Conley, 2010a; Tierney & Sablan, 2014). Researchers have suggested positive student outcomes for students who participated in dual enrollment programs to include a lower need for remediation, academic momentum, retention, and completion of degrees compared to non-participants (Grubb et al., 2017; Morgan et al., 2018; Pierson et al., 2017). Despite research showing increased degree completion and retention rates, further knowledge is recommended on the specific course subjects that are completed to determine how dual enrollment programs affect students' preparedness for college (Edmunds et al., 2020; Grubb et al., 2017; Lile et al., 2018; Morgan et al., 2018). Despite research results of positive long-term outcomes following dual enrollment participation, there is uncertainty on student performance while in the program to inform college readiness planning and improvement.

Current dual enrollment data and metrics emphasize the importance of measuring college entry and long-term outcomes rather than credit momentum and course-taking performance. Moreno et al. (2019) examined college matriculation of dual enrollment

and early college students and found that dual enrollment participants are 6.03 times more likely to enroll in college than nonparticipants. In one study, high school students who participated in early college preparatory programs and dual enrollment reduced their need for remediation in math and English by 6% (Friedmann et al., 2016). Compared to non-dual enrollment participants, dual enrollment participants were 3.4 times less likely to take remediation courses in community college and more likely to complete an associate's degree, (Grubb et al., 2017). Students who enrolled in college with dual enrollment credits had a higher retention rate of 87.2% compared to 70.4% of no dual enrolled credits (Bowers & Foley, 2018). Current college-entry, remediation, retention, and completion data used to measure dual enrollment program effectiveness prohibits timely curriculum modifications, data-informed planning, and continuous improvement.

Grade point average (GPA) is a common measure used to examine student academic performance and informs student preparedness for college-entry. The use of GPA is a traditional measure for postsecondary and high school interventions for student success and contributes to long term college outcomes including retention and degree completion (Institute of Education Statistics, 2016). Wang et al. (2015) investigated academic momentum mediating factors that lead to retention or graduation and found that dual enrollment students maintained a higher first-term GPA of 2.74 compared to non-dual enrollment participants' GPA of 2.42. Student academic performance as measured by GPA is a contributing factor for higher retention for former dual enrollment students to determine college success (Hunter & Wilson, 2019). GPA is a performance indicator used to measure student academic momentum and mediates both college readiness and

long-term student success. Conley (2010a) suggested students' course-taking patterns, number of units, and academic performance in rigorous college courses or equivalent instruction during high school is a fundamental factor to measure college readiness. GPA is a mediator and incremental measure for academic performance, college preparedness, and retention.

Governing states are responsible for establishing and enforcing policy, compliance, and oversight for dual and concurrent enrollment programs. Variation in dual enrollment policy across states and the lack of quality provisions to measure educational outcomes limit U.S. policymakers' and researchers' access to data required for policy and program improvements (Taylor et al., 2015). Policy requirements for dual enrollment reporting enables access to pertinent information essential for research and monitoring of dual credit earned and high school student dual enrollment participation (Zinth & Taylor, 2019). However, few states systematically collect data and publicly report dual enrollment student outcomes, which prevents access and use of data by policymakers and education administrators to inform program improvements and student success (Taylor et al., 2015; Zinth & Taylor, 2019). The Higher Learning Commission (2013) reviewed policies for dual credit options for all U.S. states and found inconsistencies in quality provisions to measure dual enrollment student outcomes, with Michigan ranked among five U.S. states with limited presence of quality protocols on student outcomes. Without consistent federal guidance and provisions for data collection and reporting, variation in state-wide policies and data availability may impede collaborative efforts to improve college readiness initiatives.

The Postsecondary Enrollment Options Act of 1996 (also known as Act 160) and the Career and Technical Preparation Act of 2000 (also known as Act 258) are Michigan statutes that clarify guidelines for dual enrollment. The statewide legislature provides guidance for institution eligibility requirements, course offerings, and student eligibility for dual credit options provided to high school students (Career and Technical Preparation Act, 2000; Postsecondary Enrollment Options Act, 1996). Michigan adopted performance-based funding guidelines and criteria for dual enrollment participation, course credit completion for high school students, but there are no state-wide guidelines or reporting requirements for program quality provisions or student postsecondary outcomes (Higher Learning Commission, 2013; Michigan Department of Education, 2018). Michigan legislature govern provisions for eligibility and course requirements to aid consistency for accessibility and curriculum across institutions of higher education, but inconsistent data collection and guidance inadvertently limits measurement of program effectiveness and college readiness.

Data collection for Michigan dual enrollment programs focus on program outputs specific to credit completion for budgeting purposes rather than performance outcomes that motivate and inform program quality assurance and improvement. The State of Michigan requires postsecondary institutions to report on fees, number of paid college courses, and credits for eligible students who participate in dual credit programs (Michigan Department of Education, 2018). The data collected by Michigan legislation are focused on funding-related areas, rather than dual enrollment program quality outcomes and student outcomes. The Michigan Department of Education (2018) reported

an increase of postsecondary credits earned in dual enrollment programs from 61,444 in 2014-2015 to 103,522 in 2018-2019, representing an increase in the number of college credits completed by high school students each year. In this study, I examined the relationship between the number of earned college credits completed in general education, career and technical education, and community college orientation courses during dual enrollment program and first-term college GPA as a measure of college readiness. The study focused on a Michigan community college's dual and concurrent enrollment program. Study findings may inform development of useful college readiness metrics for Michigan community college leaders and state policymakers; facilitate dual enrollment curriculum alignment with partnering secondary and community colleges; and allow stakeholders to gauge dual credit program effectiveness and develop improvements.

Problem Statement

The problem studied was the lack of information about how early college credits earned in specific core disciplines during high school dual enrollment programs relate to college readiness in the first year of community college. Dual enrollment programs provide early college experiences for students attending high school that focus on two college readiness components: rigorous college-level course work and college-going behavior development skills (Bowers & Foley, 2018). Despite the growth in the number of college credits earned during dual enrollment programs, there is limited data to understand how dual enrollment programs meet goals for student success (Pretlow & Patteson, 2015). In this quantitative study, I examined how the number of college credits

in general education, career and technical education, and community college orientation courses earned in a Michigan community college dual enrollment program relate to college readiness as measured by their first-term GPA.

Advancing knowledge on course-taking units and disciplines may aid in evaluating academic momentum and effectiveness of dual enrollment programs. The goals of dual enrollment programs are to advance rigorous college-level coursework and early college experiences while students are in high school, yet there is a lack of understanding of how college credits earned in different subjects during dual enrollment programs relate to college readiness (Edmunds et al., 2017; Fletcher et al., 2018). Grubb et al. (2017) recommended further research on college courses completed in dual enrollment programs to understand how to prepare students for the academic rigor of college. Similarly, Morgan et al. (2018) and Wang et al. (2015) suggested the need to further research courses completed in college preparatory courses, general education, and career-oriented disciplines during dual enrollment programs. Exploring college credits earned in dual enrollment programs could clarify how to prepare students to meet academic expectations of college and increase the number of students who complete degrees (Grubb et al., 2017; Pierson et al., 2017). Dual enrollment programs have a cumulative effect on college outcomes, yet there is a lack of information and understanding of how the types of college credits earned in dual enrollment programs contribute to college readiness (Edmunds et al., 2020; Morgan et al., 2018). College credits earned in dual enrollment facilitate multiple advantages that support college readiness and postsecondary success.

Dual enrollment programs have long-term benefits for both high school students and community colleges (Stokdyk et al., 2020). Community colleges benefit from potential enrollment of former dual enrollment students who previously earned college credits towards their degree (Moreno et al., 2019). As enrollment in community colleges decline, dual enrollment programs provide potential recruitment opportunities that may aid degree completion and retention at the institution (Bush, 2017; Martinez et al., 2018). Dual enrollment programs have an overall positive effect on students college enrollment, timely degree completion, and retention from one semester to the next (Fink et al., 2017; Grubb et al., 2017; Hunter & Wilson, 2019). Examining students' and community colleges' dual enrollment program outcomes may advance research on structural reform and college readiness in high education (Tobolowsky & Allen, 2016). Although dual enrollment programs exhibit cumulative benefits for students and community colleges, educational leaders and policymakers have limited data to understand program effectiveness and inform improvements.

Dual enrollment outcomes data and information are limited due to the variation or lack of state-wide policy requirements for student eligibility, course offerings, funding, and quality provisions (Zinth & Taylor, 2019). Variation in state-wide dual enrollment policies has resulted in inconsistency and limited access to program data regarding quality provisions and outcome reporting protocols (Taylor et al., 2015; Tobolowsky & Allen, 2016a). Taylor et al.(2015) reviewed dual enrollment policy for the presence of quality provisions and found 16 states whose policy requirements addressed protocols to collect data and reports on enrollment student outcomes. The Higher Learning

Commission (2013) conducted a dual credit policy analysis in which it ranked Michigan among the lowest states nation-wide for presence of quality provisions. Comprehensive data and measures of dual enrollment outcomes for students who matriculate to postsecondary education are essential to inform policy improvements related to equity, access, program improvement, and student outcomes (Zinth & Taylor, 2019). Therefore, there is a need for more comprehensive measures of college readiness outcomes to understand the relationship between earned college course credits in dual enrollment programs and college preparedness (An & Taylor, 2015; Edmunds et al., 2020). In this study, I investigated the number of credits earned in three core disciplines (general education, career and technical education, and community college orientation courses) by former dual enrollment students during high school and how it relates to college readiness to provide insight for program outcomes data collection for a Michigan community college.

Purpose of the Study

The purpose of this quantitative study was to examine the relationship between the number of college credits earned in general education, career and technical, and community college orientation courses completed by former dual enrollment students in high school and their first-term GPA upon enrollment at the partnering Michigan community college. This study focused on students who participated in a Michigan community college dual enrollment program while in high school and who later enrolled in their first year of community college with no previous college enrollment. The number of earned college credits by former dual enrollment participants in general education,

career and technical education, and community college orientation courses (independent variables) constituted the predictor variables. First-term GPA was the dependent or outcome variable.

I performed multiple and simple linear regression analyses to examine predictive relationships between each predictor and outcome variable collectively and individually. The regression analysis explained the overall model fit, strength and direction of the relationship, and predictability of first-term college GPA. I investigated how the predictors contributed to the variance in first-term GPA as a measure of college readiness. Few quantitative researchers have investigated the relationship between college credits in core disciplines earned by dual enrollment students who enroll in community college and the students' academic performance in their first year of college. This study may contribute to current research by expanding knowledge on how college credits earned in discipline-specific course areas during dual enrollment may predict college readiness as measured by academic performance in their first year of community college. Specifically, the research data may clarify determinants of college readiness, which may inform the development of state-wide metrics and as well as policy improvements for Michigan community colleges.

Research Question and Hypotheses

The overarching RQ for this quantitative study was, To what extent does the number of college credits earned during dual enrollment in general education, career and technical education, and college readiness courses predict GPA in the first year of community college? I developed the following hypotheses to test the association between

the predictor variables (the number of college credits earned by dual enrollment students in general education, career and technical education, and community college orientation courses) and the criterion variable (first-term GPA in the Michigan community college):

$H_0 1$: There is no statistically significant relationship between the number of college credits earned in general education, the number of college credits earned in career and technical education, the number of college credits earned in community college orientation courses collectively by dual enrollment participants, and first-term college GPA in community college.

$H_a 1$: There is a statistically significant relationship between the number of college credits earned in general education, the number of college credits earned in career and technical education, the number of college credits earned in community college orientation courses collectively by dual enrollment participants, and first-term college GPA in community college.

$H_0 2$: There is no statistically significant relationship between the number of college credits earned in general education courses by dual enrollment participants and first-term college GPA in community college.

$H_a 2$: There is a statistically significant relationship between the number of college credits earned in general education courses by dual enrollment participants and first-term college GPA in community college.

$H_0 3$: There is no statistically significant relationship between the number of college credits earned in career and technical education courses by dual enrollment participants and first-term college GPA in community college.

H_a3: There is a statistically significant relationship between the number of college credits earned in career and technical education courses by dual enrollment participants and first-term college GPA in community college.

H_04: There is no statistically significant relationship between the number of college credits earned in community college orientation courses by dual enrollment participants and first-term college GPA in community college.

H_a4: There is a statistically significant relationship between the number of college credits earned in community college orientation courses by dual enrollment participants and first-term college GPA in community college.

Theoretical Framework for the Study

I grounded the study in Conley's key dimensions of college and career readiness model. Conley (2010) posited that a student who is prepared for college exhibits key cognitive strategies, content knowledge, academic behaviors, and contextual skills and awareness in high school and college readiness programs. Each dimension builds a framework of skills and knowledge required to help high school students succeed in completing college courses towards a degree or career pathway (Conley, 2010). Conley's key dimensions of college and career readiness model outlines the key dimensions and the fundamental factors required to measure college readiness for students in high school programs. This section briefly describes the theoretical dimensions and determinants for measuring college readiness.

Conley's model describes an interconnected network where the dimensions continuously interact to prepare a student academically and behaviorally for college

success without remediation (Conley, 2010). Key cognitive strategies refer to thinking skills to include critical thinking, reasoning, and problem-solving that are integrated in entry-level college core subject areas (Conley, 2010a). Content knowledge is the mastery of curriculum content in core subject areas such as mathematics, English, social sciences, world languages, and arts to develop cognitive strategies (Conley, 2010a). Academic behaviors are metacognitive skills students develop such as self-awareness, confidence, self-monitoring, and self-management (Conley, 2010a). Contextual skills and awareness are specific skills students develop to navigate the college environment and systems such as institutional norms, support and financial service navigation, college culture, multiculturalism, admission policies, and student code of conduct (Conley, 2010a). High school students who successfully complete entry-level best practice courses in general education or career and technical education gain experience and skills in core subject areas that prepare them for success in college (Conley, 2010a). Both key cognitive strategies and content knowledge dimensions focus on students' academic performance as a measure of college readiness (Conley, 2010a). Each dimension is discussed further in Chapter 2 and how it relates to the scope of the study.

Conley suggested a student is more likely to be college-ready if their experiences in high school and early college programs include extensive knowledge in core subjects and development of problem-solving, analysis, communication, self-management, and college navigation skills (Conley, 2010). Dual credit programs enable high school students to earn early college credits that advance academic rigor, preparation, and content knowledge related to their future college study interests (Conley, 2010a). Conley

(2010) suggested a fundamental measure of college and career readiness include high school student course-taking history, GPA, and academic performance in college-entry courses or equivalent coursework. This study explored the college-entry best practice courses outlined in the content knowledge dimension to understand how the number of early college credits earned by dual enrollment students during high school relates to college readiness in their first year of community college.

Conley's key dimensions of college and career readiness model, informed my study's purpose, which examined the contribution of key academic dimensions of core content knowledge and cognitive strategies to prepare students for college entry. The study focused on the early college courses and units earned during dual enrollment programs using college GPA as a fundamental measures of college readiness. This study examined how former dual enrollment students' direct early college experience with content knowledge based on college credit units earned in three core discipline areas explain how they relate to college readiness measured by first-term college GPA. Early college credits earned in dual enrollment programs are aligned to the theoretical framework by providing high school students direct college experiences through rigorous college coursework as a primary measure of student readiness for college.

Nature of the Study

The nature of this study was quantitative. I used regression analysis to examine the extent of the relationship between the number of college credits earned in general education, career and technical, and community college orientation courses during dual enrollment programs (predictor variables) and first-term college GPA (criterion variable).

Archival transcript data on former dual enrollment students' college credits earned in high school and their first-year community college GPA was collected from a Michigan community college information system to examine college readiness. The study focused on college course-taking patterns while in the dual enrollment program and their first-term college GPA. The predictors and criterion variable were aligned to the Conley's key dimensions of college and career readiness theoretical framework to measure college readiness based on their early college dual enrollment academic performance. The scope of this study focused on a Michigan community college dual enrollment program to include students who earned college credits while in high school with no previous college enrollment prior to their first year at the community college.

Regression analysis explained the extent of the relationship between each predictor variable individually and collectively to determine how the predictors estimate variation in the criterion variable and predict first-term GPA, as a measure of college readiness. A multiple linear regression statistical test was conducted to explain model fit and summarize how several predictors collectively contribute to the estimated variance in the criterion variable (first-term community college GPA). A simple linear regression analysis was conducted for each individual predictor to further characterize and explain the strength and direction of the relationship between each pair of predictors and the criterion variable. Overall, the series of simple linear regressions was conducted determine the extent that earned credits in each discipline predicted change in the first-term GPA of former dual enrollment students at the Michigan community college. Balfanz et al. (2016) suggested using a multifaceted approach of analyzing GPA and

course completion in early college experiences to determine college readiness. This study analyzed archived transcript data to include the number of college course credits earned by dual enrollment participants in three core disciplines and their first-term college GPA to predict college readiness.

Definitions

Career and technical education: Courses that provide core academic skills, specific career training, and technical skills that prepare students for jobs in various workforce industries (Gauthier, 2020).

College readiness: The academic preparation and knowledge required for a student to succeed in college as measured by their performance in college courses, standardized test scores, and GPA (Conley, 2010a; Malin et al., 2017).

Dual credit: College credit earned by high school students due to their enrollment and completion of college courses during dual and concurrent enrollment programs (Higher Learning Commission, 2013).

Dual enrollment: A type of enrollment that allows students to earn college credit while in high school, as outlined in secondary and postsecondary partnerships (Fletcher et al., 2018; Jones, 2017). Dual enrollment is also referred to as "concurrent enrollment" or "dual credit" because students complete college courses that are taught in the high school, online, or college campuses by college faculty or high school teachers who are certified to teach college courses (Higher Learning Commission, 2013).

First-time students: Any student who attends a college for the first time and has no prior enrollments in any other college (National Center for Education Statistics, 2022a).

First-year college students: Students who enrolled in college for the first time regardless of completion of college credits while in high school through participation in dual and concurrent enrollment programs (National Center for Education Statistics, 2022a).

Former dual enrollment participant: A high school student who participated in a dual or concurrent enrollment program and earned early college credits while in high school (Jones, 2017). For the purpose of this study, former dual enrollment students are students who earned college credits at the partnering community college and attended the college without prior enrollment in another college.

Assumptions

This study utilized a convenience sample from archival transcript records data from the partnering Michigan community college for first-year students who formally participated in the dual enrollment programs. Therefore, it is assumed that all high school students who completed college credits during dual enrollment programs met the admission requirements to enroll in community college. It is also assumed that the first-term college GPA is based on the first year that the former dual enrollment student enrolled in the community college without any previous enrollment to other colleges. The data were requested for former dual enrollment students who attended the Michigan community college for the first-time during 2017 to 2020 with no previous college

enrollment in other institutions. The assumptions provided clarity for the sample population parameters to ensure that former dual enrollment students' college readiness was measured in their first enrolled year at the partnering community college.

Scope and Delimitations

This nonexperimental quantitative study examined the relationship between the number of college credits earned in general education, career and technical education, and community college orientation courses by former dual enrollment students and their first-term college GPA at the partnering Michigan community college. The former dual enrollment student enrolled in their first year of community college without prior college enrollment history from another postsecondary institution. Former dual enrollment students with no prior college enrollment limited exposure effects from previous college courses and inclusion of non-first year students. The first-term GPA was selected to measure academic performance in their first year of college, rather than the cumulative GPA, which represented their entire academic history at the community college. The sample inclusion criteria accounted for prior college exposure and maturation effects in measuring college credit attainment and academic performance to determine college readiness.

The student population represented a convenience sample of former dual enrollment students who enrolled in the Michigan community college for the first-time from multiple partnering local school districts. The sample was representative of high school students from multiple partnering high schools and districts who participated in dual enrollment and enrolled during 2017 to 2020 at a Michigan community college.

Therefore, generalizability is limited to dual enrollment programs hosted by the Michigan 2-year colleges and not including 4-year universities. To avoid the effects of dropping out of high school on academic performance, dual enrollment students who completed their general equivalency diploma (GED) were not included in the study population. The population scope of this study comprised of archival transcript data of former dual enrollment students from a Michigan community college. Therefore, discretion is advised for interpretative purposes related to former dual enrollment students who enrolled in 4-year colleges and universities or 2-year institutions in other governing states.

Limitations

This was a nonexperimental, quantitative study. I used regression analysis to analyze data from a nonprobability convenience sample. Therefore, there are limitations related to using a convenience sample from the partnering institution information system. The convenience sample was dependent on data availability and quality methods established by the college. Although there are sampling limitations from archival sources, the collected sample size was larger than the minimum sample size derived from the G*Power analysis. The purpose of the study examined the relationship between the predictors and criterion variable, not to determine a causal relationship. Nevertheless, the use of regression analysis featuring both multiple linear regression and simple linear regression may advance knowledge related to the model fit, strength and direction of the related variables, and estimation of what extent the predictors individually and collectively explained change and predict criterion variable.

Additionally, there were limitations due to data availability, institutional staffing, and time constraints for providing the required variables for the study. Recent health concerns and regulations imposed by COVID-19 challenged college staffing and institutional participation in research initiatives. Also, dual enrollment program enrollment was suspended due to closing of high school facilities to limit widespread exposure. These unexpected factors extended the amount of time for processing the data request and the size of the sample due to lower enrollment during 2019 to 2020. To address potential data access barriers and availability, I communicated with appropriate college staff and leadership to properly submit a data request clarifying the process for analyzing the data and the format required for the statistical test. This study differs from current research for dual enrollment programs by describing how college credit attainment data in specific disciplines may predict college readiness and incrementally evaluate program effectiveness.

Significance

This study may contribute to limited knowledge and information related to college credits earned by high school students in community college dual enrollment programs and its relationship with first-term college GPA to provide insight into college readiness policy development and metrics. The study may advance existing knowledge on predictive measures of college readiness to address the lack of research on contributing academic factors of dual enrollment programs and how they prepare students for college success (Thomson, 2017; Zinth & Taylor, 2019). The academic performance and earned college credits in core disciplines may inform collaborative decisions by high

school and community college administrators to improve curriculum alignment and develop a shared goal of college readiness. Findings may inform positive social change refining dual credit policies, quality provisions, and metrics focused on college readiness to support dual enrollment program effectiveness. Additionally, stronger collaborative relationships between secondary and postsecondary education will aid intentional education reform efforts to close the gap for college credential attainment required for employment in a high-skill workforce in the United States.

Summary

Dual enrollment programs impact the growth of early college credits earned in high school and is contributing factor for sustaining college enrollment and educational attainment in the U.S. higher education. Current research demonstrated the long-term benefits of positive student outcomes related to reduced need for remediation, retention, and degree completion (Clovis & Chang, 2021; Grubb et al., 2017; Wang et al., 2015). Yet, there is sparse data collected on incremental metrics to inform policy and program effectiveness due to inconsistent and varying governing policies that enforce compliance and reporting for student outcomes This study attempts to further research and data to measure the extent to which college discipline-specific credits earned during dual enrollment programs in Michigan relate to college readiness in the first year of community college. Discretion is advised for interpretation purposes for other states and 4-year university early college programs. Chapter 2 provides details from previous literature analysis and the theoretical framework that grounded the study and research methodologies.

Chapter 2: Literature Review

Dual enrollment programs provide early exposure and access to rigorous college content to contribute to overall college readiness. Dual enrollment students benefit from a rigorous high school curriculum by earning college credits that prepare them for college (Martinez et al., 2018). Still, there is little research to understand which academic components contribute to college readiness (Morgan et al., 2018). Morgan et al. (2018) and Wang et al. (2015) suggested the need for further research on how courses completed in college preparatory, general education, and career-oriented disciplines during dual enrollment programs. This knowledge is necessary to examine college readiness. The purpose of this study was to examine the relationship between the number of college credits earned in general education, career and technical, and college readiness courses completed by former dual enrollment students and their first-term GPAs upon enrollment at the partnering Michigan community college.

In this study, I sought to contribute data and findings that could inform dual enrollment curriculum development by high school and community college administrators; advance use of student academic performance metrics to evaluate dual enrollment program effectiveness and student outcomes. I begin this chapter by explaining the literature review strategy and describing Conley's (2010) key dimensions of college and career readiness theoretical framework that grounded the research study. Then, I provide a comprehensive review of current literature related to the measurement of college readiness and the role of dual enrollment programs in preparing students for college. The study's theoretical framework, Conley's (2010) college and career readiness

theory, contextualizes how dual enrollment programs and practices inform improvement of college readiness. The literature review focuses on measures of college readiness; the role of community colleges; and key elements related to dual enrollment to include governance, policy, student outcomes, benefits, limitations, and educator perspectives. To conclude the chapter, I reaffirm the need for further research on how college course credits earned in different disciplines relate to college readiness in the chapter summary.

Literature Search Strategy

To conduct an in-depth review of the most current peer-reviewed research, I used education databases to include Education Source, APA PsycINFO, PsycBOOKS, PsycARTICLES, MPDI, Career and Technical Education Database, Sage Journals, Taylor & Francis Online journals, Project Muse, and Wiley Online Library. Walden University's Thoreau Multi-Database tool provided access to many database resources. I also searched the National Center for Education Statistics' Publications & Products webpage and used the search engine Google Scholar. Keywords utilized include *dual enrollment*, *dual credit*, *early college*, *concurrent enrollment*, *dual enrollment outcomes*, *college and career readiness*, *early college programs*, *dual credit programs*, *community college dual enrollment*, and *2-year college dual enrollment programs*. The literature search spanned literature published from 2016 to 2021 to include seminal articles that reference foundational knowledge for dual enrollment and college readiness. Each article was analyzed and organized according to major themes to explain how current knowledge informed the study's problem statement, purpose, and RQ.

To broaden the search, I linked Google Scholar to the Walden University Library; this allowed me to perform an exhaustive review of available peer-reviewed literature and reports from available library databases. Reports from the U.S. Department of Education's National Center for Education Statistics, the Institute of Education Sciences, the Community College Research Center, ACT, MI School Data, and the National Student Clearinghouse Research Center provided dual enrollment program data from a national perspective and were found using Google Scholar. Literature found with Google Scholar was evaluated for reliability and peer-reviewed status to expand the literature review strategy.

Theoretical Foundation

Conley's (2010) key dimensions of college and career readiness theory explains how earning college credits in dual enrollment programs enable academic rigor and fundamental approaches to measuring college readiness. Conley's key dimensions of college and career readiness model's primary goal is to provide a framework for evaluating and developing early college experiences that reduce remediation by preparing students for academic rigor and college success (Conley, 2008). Conley's key dimensions of college and career readiness posits that a student is prepared for college based on their demonstration of four key dimensions (cognitive strategies, content knowledge, academic behaviors, and contextual skills and knowledge) developed during high school. The four interconnected key dimensions explain how early college programs and initiatives advance college readiness. As I demonstrate in this section, the model was appropriate for this investigation of the relationship between college course credits earned in core

disciplines during dual enrollment programs and college readiness. In this study, I describe each dimension and focus on two of the academic knowledge-related dimensions.

Each dimension of Conley's (2010) college and career readiness model distinguishes fundamental skill development to prepare students for success in college. Early college exposure enables key contextual skills and knowledge dimension comprised of college-going norms such as admission, advising, applying for financial aid, and faculty-student relationship spans beyond academic performance in college courses (Conley, 2010). Contextual skills and knowledge prepare students to navigate cultural and postsecondary institution norms and processes. During dual enrollment programs, students are exposed to key elements in relation to this dimension to develop college-going habits, behaviors and skills in preparation for their first year of college. College readiness is essential to help students succeed beyond admission and promote college credit completion, persistence, and navigation of college culture and systems.

Key cognitive strategies and academic behaviors are related to thinking and behavioral skills that prepare students for college success beyond enrollment. Key cognitive strategies dimension represent skills focused on how a student intentionally thinks, learns, understands, and employs college-going behaviors and habits purposefully for the best results to succeed in college (Conley, 2008). Key cognitive strategies include problem-solving, inquiry, analysis, and accuracy are important skills required for students to succeed in college courses across all disciplines and subject areas (Conley, 2008). The academic behaviors dimension clarifies metacognitive skills that describe specific

attitudes and college-going behaviors required for resilience in the college environment, including study skills, self-reflection, self-management, ownership, prioritization, and time management (Conley & French, 2014). Conley and French (2014) studied the model to understand ownership of learning and clarified the importance of metacognition skills, which help students develop self-confidence, self-efficacy, self-monitoring, and motivation to succeed in college. Earning college credits in high school enhances the curriculum and develops cognitive strategies, metacognition skills, and academic behaviors that prepare them for completion of entry-level college courses successfully (Conley, 2010a). Both cognitive strategies and academic behaviors promote metacognitive resilience to enable persistence and management strategies that help students continue to the next year and complete their educational goals.

Key content in core academic subjects are imperative in preparing students for college enrollment without requiring remediation. The key content knowledge dimension describes foundational academic knowledge including English, mathematics, social sciences, science, and entry-level career education without remediation (Conley, 2008). Conley (2010) postulates that college-level courses in general education prepares students with the core knowledge that promotes cognitive skill development and readiness to further their education. Strengthening high school curriculum rigor by increasing the number of courses in each of these college-entry disciplines advances key content knowledge and college readiness (Conley, 2010). Conley (2010) suggests that college courses or equivalent college-entry coursework completed in high school serves as a fundamental measure to determine a students' college readiness. This study examined

key facets related to key cognitive strategies and content knowledge acquired by earning early college credits while in high school and how it relates to college readiness.

Cognitive strategies and content knowledge are key dimensions central to demonstrating academic preparedness for college entry and success. Conley's (2010) model suggests a network of interconnected skills within each dimension continuously interact to prepare a student for general college course content without remediation and develop necessary college-going attitudes and social skills. Conley proposes that course-taking patterns and the number of units completed in best practice college-entry courses in high school are key determinants for measuring college readiness. This chapter provides more details on best practice courses contribution to academic preparedness and how they are measured to determine college readiness. Although each dimension is important and interconnected, this study focused on academic content and preparedness contribution to college readiness.

The study is grounded in Conley's key dimensions of college and career readiness model's key cognitive strategies and content knowledge dimensions while using the fundamental proxies for measuring college readiness. Conley posits that students prepared for college exhibit academic knowledge and proficient performance skills in core subject areas. Although Conley's key dimensions of college and career readiness model suggests preparedness is determined according to proficiency in four dimensions, this study focuses on the two academic-centric dimensions associated with measuring academic preparedness and success in first-year college courses. Conley postulates course-taking patterns in high school and their academic performance measured by GPA

are common strategies to determine college readiness for early college programs or equivalent curriculum. Conley suggests that high school students who completed best practice college-entry courses in general education and entry-level career education were more likely to exhibit key cognitive strategies and content knowledge and will be prepared to advance their studies in college. Current literature suggested students are more likely to be ready for college if they complete a rigorous curriculum in high school that prepares them for college course content without remediation (Fletcher et al., 2018; Morgan et al., 2018). In addition to enhancing high school curriculum, incremental measures of college readiness and student outcomes may aid program improvement and collaborative planning.

A fundamental measure of college readiness examines rigorous course-taking patterns in core college courses or equivalent instruction in high school. Evaluating academic performance according to course-taking patterns and units are essential factors in measuring postsecondary readiness (Conley, 2010a). GPA is a traditional measure of academic performance and is an essential proxy for evaluating postsecondary reform initiatives (Institute of Education Statistics, 2016). This study is aligned with Conley's key dimensions of college and career readiness model, which posits that a prevalent approach to determining college readiness is dependent on a high-school students' course-taking patterns in college-entry courses and their academic performance measured by their GPA. This study focused on the content knowledge and content strategies dimensions as the fundamental approach to explore college-entry course-taking patterns and earned credits in dual enrollment programs. Understanding former dual enrollment

students' course-taking patterns, while in high school may inform measures of college readiness, guide policy and curriculum development, and students for college.

Literature Review Related to Key Variables and/or Concepts

College Readiness

Postsecondary and secondary education is challenged by the number of students who complete high school underprepared for college-level coursework and require remediation (Chen, 2016). Educators defined college readiness as students' preparedness academically and behaviorally to enroll in college and successfully perform in college courses without remediation (Conley, 2010a). College readiness initiative reform revealed a misalignment between secondary and postsecondary in preparing students for college enrollment and student success in their first year (Tierney & Duncheon, 2015). However, there are limitations in researchers and educators access to comprehensive data to inform reform initiative improvement for early college programs (Zinth & Taylor, 2019). According to Balfanz et al. (2016), educators should broaden how college readiness is evaluated by measuring high school course-taking patterns and student performance in college preparatory curriculum to include advanced mathematics, science, reading, writing, and computation. Dual enrollment programs are popular college readiness reform initiatives that provide academic rigor and college-going behaviors to high school students that facilitate seamless transition to college (Edmunds et al., 2017). College readiness reform initiatives require comprehensive metrics and to clarify key factors that mediate preparedness for college-entry and subsequent success.

College readiness should prepare students academically to enroll without remediation and achieve their degree completion goals beyond the first year of college. With 55.5% of 2015-16 undergraduates who attend community colleges taking at least one remedial course after high school compared to 30.9% from 4-year undergraduates, college readiness is an important issue impeding student success and completion of college degrees (Campbell & Wescott, 2019). Remediation challenges students' college readiness resulting in longer degree completion times, greater accrued debt, and a higher risk of drop-out (Cevallos et al., 2016; Community College Research Center-Columbia University, 2012; Saw, 2019). There is concern that high school students met college admission requirements, but are not ready to succeed in credit-bearing college courses and complete degrees (Balfanz et al., 2016). Harvey et al. (2013) examined college readiness literature and suggested a shared approach by postsecondary and secondary systems to define inclusive college readiness measures beyond admissions requirements and standardized testing. The large number of students who meet college admission requirements for college, but require remediation is a concern and called for postsecondary reform initiatives to improve college readiness (Chen, 2016). Research findings clarified positive outcomes for students who completed rigorous college preparatory courses in high school that led to higher college enrollment rates, persistence, and completion of degrees (Morgan et al., 2018). Continued research and evaluation of college readiness programs outcomes may enhance availability of consistent data, define college readiness, improve policy and overall educational attainment.

Educators continued to examine college readiness and identified important factors that hinder student preparation for college enrollment. Harvey et al. (2013) conducted a meta-analysis of college readiness policy literature that revealed the need for establishing a clear, comprehensive, and collaborative approach focused on measuring college readiness programs beyond culturally-biased standardized testing and admission requirements. Malin et al. (2017) examined the college and career readiness policies of the Illinois Every Student Succeeds Act and identified opportunities for broadening equity and access to rigorous general education and career and technical coursework; clarifying state policies and developing inclusive accountability measures to include student performance. Current literature investigated college readiness and identified deficiencies in both secondary and postsecondary policies to improve dual-credit programs quality and contribution to college readiness(Taylor et al., 2015). This quantitative study examined former dual enrollment students' academic college credit attainment in three best practice disciplines to predict the first- term GPA as a measure of college readiness.

Measures of College Readiness

Although measures of college readiness are limited and vary for each state, there are studies that describe contributing variables to examine academic performance and outcomes. College readiness has been measured with a variety of strategies based on course-taking patterns, academic performance in high school and standardized tests to determine preparedness for entry-level college courses (Conley, 2010a; Tierney & Duncheon, 2015). A fundamental measure of college readiness is determined according

to academic rigor of coursework in different subject areas and their GPAs in high school to prepare students for entry-level college courses (Conley, 2010a). Students who participate in rigorous high school curriculum to include AP and early college credits were more likely to demonstrate positive college outcomes (Morgan et al., 2018). Standardized and achievement tests are taken in high school to assess student performance based on assessment scores and college admission benchmarks (Tierney & Duncheon, 2015). High school students who complete rigorous study in core subjects in general education and entry-level career education are more likely to be prepared for entry-level college study (Conley, 2010a). Rigorous academic content in high school is an important factor to advance college readiness, which implies a need to further understand how early college course completion affects postsecondary performance.

Grade point average in high school serves as an indicator of successful completion of academic content to measure of academic readiness and inform college admission. GPA is a key determinant for college readiness and is a traditional measure for postsecondary intervention success (Institute of Education Statistics, 2016). Researchers use the GPA for students in their first year of college as an indicator for postsecondary success and academic achievement (Tierney & Duncheon, 2015). Fina et al. (2018) used first-year college GPA as a broad measure of academic achievement to explain how ACT standardized test scores predict higher first-year GPA as a determinant for college readiness. Academic momentum refers to the successful completion of college credits, with GPA as a contributing factor to determine student success outcomes such as retention and degree completion (Clovis & Chang, 2021). Academic momentum research

suggested that dual enrollment students were more likely to have a higher GPA than their counterparts overall (An, 2015). GPA evaluates academic preparedness and is an important factor that contributes to academic momentum and readiness for subsequent completion of college course units.

Academic momentum measured by GPA facilitates continuous completion of rigorous college-entry courses towards college completion. Research provides empirical data that cumulative GPA is a contributing factor for higher outcomes related to retention and graduation rates for dual enrollment students compared to their counterparts who did not participate in dual enrollment (Bowers & Foley, 2018; Hunter & Wilson, 2019). Research findings conclude that dual enrollment participation resulted in higher cumulative GPA for first-time, full-time college students resulting in higher persistence compared to non-participants (Jones, 2014). Wang et al. (2015) examined academic momentum and found that GPA is a mediating factor for dual enrollment students' higher retention and degree completion rates. A primary measure of college readiness should focus on the course-taking patterns and performance in early college courses or equivalent study in high school to reduce the likelihood of students taking remedial education (Chen, 2016; Conley, 2010a; Tierney & Duncheon, 2015). Dual enrollment programs promote academic momentum and allows students to complete early college credits, while simultaneously preparing students for college success and degree completion (Karp, 2015). Utilizing comprehensive data and metrics related to academic momentum may aid in incremental evaluation of dual enrollment programs to determine how curriculum content relates to first-year GPA.

Although dual enrollment programs have grown continuously in the last decade, there are concerns regarding limited data to evaluate access for all students and program effectiveness to improve college readiness. Zinth and Taylor (2019) argued that institutional researchers play a valuable role in aligning data collection and reporting for dual enrollment. Comprehensive data to measure dual enrollment participation, access, and outcomes would provide policymakers adequate data for evaluating dual-credit policy components and program effectiveness (Taylor et al., 2015). As dual and concurrent enrollment programs increased in composition of postsecondary enrollment, concerns have grown due to the lack of comprehensive measures to determine who participates, college readiness, and overall program effectiveness (Thomson, 2017). Students who have enrolled in dual enrollment programs have increased, yet policies and data collection of college readiness metrics have not advanced to understand capacity and program effectiveness (Pretlow & Patteson, 2015). There are various measures of college readiness, but the inconsistent collection and definitions for metrics related to dual enrollment program effectiveness and student outcomes prohibits a clear understanding of primary elements that advance college readiness beyond college entry.

Community College Dual Enrollment Programs

Community colleges partner with high schools to provide early college experiences for high school students focused on college-going behaviors and early college credit attainment. Dual and concurrent enrollment programs are reform initiatives implemented by partnering secondary and postsecondary institutions to promote early college exposure and college credit completion at reduced costs while attending high

school (Jones, 2017; Thomson, 2017). Essential early college program components include rigorous college course content, transferability, accessibility for all students, and reduced tuition expense for dual and concurrent enrollment programs ensure students' quality experiences (Pretlow & Patteson, 2015).. As community colleges seek to create pathways from high school to college enrollment with dual enrollment programs, data related to academic achievement and program outcomes specific to college readiness may strengthen partnerships and promote seamless transferability of earned credits.

Dual enrollment programs are offered according to agreements between postsecondary and secondary institutions to enhance the curriculum and prepare students for their college-going aspirations. The partnership agreements focus on student eligibility requirements, course content, instructors, and schedule management to align early college opportunities with high school structures. College courses in dual or concurrent enrollment programs are taught in high schools, college campuses, or online by master's prepared faculty or certified high school teachers (Higher Learning Commission, 2013). Arnold et al. (2017) examined dual enrollment grades in English, Biology, Math, and History courses to compare performance in different instruction modalities and found students who completed in high school or online performed better than those who completed college credits on college campuses. Harvey et al. (2013) emphasized the importance of high school teachers' preparedness to teach college course-content, while developing social behaviors to promote college readiness. Dual enrollment instruction must be taught by college faculty or high school teachers certified with the same credentials required by postsecondary institutions (Horn et al., 2016). Another

concern of dual enrollment program growth is equivalency of college course content and rigor compared to traditional courses taught in college.

Researchers have examined academic rigor to assess how early college credits and AP courses promote college readiness and success. Dual enrollment programs provide academic and non-academic skills through college credits to prepare students for degree completion, retention and success (Hunter & Wilson, 2019). Dual enrollment programs created seamless pathways for high school students to enroll in college at higher rates while acquiring college credits that led to higher degree completion rates (Edmunds et al., 2017). Dual credit programs provided students the opportunity to complete college courses to meet general education and high school requirements and ease the transition to college (Bowers & Foley, 2018; Edmunds et al., 2017). Morgan et al. (2018) and Jones (2014) investigated the relationship between rigorous preparatory coursework and postsecondary success and found that students who completed AP or early college credits were more likely to enroll in college, persist and complete a degree. Bowers and Foley (2018) further examined the differences between students who completed AP English, Mathematics, and dual enrollment college credits and found there were no differences in their fall-to-fall retention and they both were more likely to have higher retention rates than their counterparts who did not take AP courses or dual enrollment.

The Role of Community Colleges

High school students completed college courses through dual and concurrent enrollment programs offered by 4-year universities and 2-year community colleges, with

majority enrolled through community colleges (Fink et al., 2017). Community colleges play a significant role in closing the educational attainment gap required for equitable access to underserved populations who would not generally attend college and a highly credentialed workforce (Barnett et al., 2015). The American Association of Community Colleges (2020) reported enrollment in 2-year community colleges representing 50% minority race/ethnicities, 29% first in their families to attend college, 57% receiving need-based financial aid grants, and 15% single parents representing underrepresented student populations. Jones (2017) studied the mission of the community college and found them best suited to provide underrepresented high school students early pathways to college and careers at reduced costs while linking students to businesses and industries in the workforce. Fink et al. (2017) found that 84% of dual enrollment participants re-enrolled at the 2-year community college that hosted their dual enrollment program. Literature supported the community college's role in addressing college and career readiness by providing high school students with rigorous academic and college-going skills for underserved students.

Community colleges are uniquely positioned to provide high school students with early credit-bearing college courses and experiences that benefit both the institution and students. Community colleges are more flexible in responding to dynamic changes and needs of its students and workforce more rapidly than 4-year universities (Jones, 2017; Pierson et al., 2017). Two-year colleges and universities create pathways for dual enrollment students to obtain occupational and technical skills and credits to fill employment gaps in the workforce (Taylor et al., 2015). Overall, career and technical

college courses completed in dual enrollment optimized students exposure to skill development, career exploration, and increased potential for degree completion (Morgan et al., 2018; Phelps & Chan, 2017). Despite challenges with funding, transportation, and scheduling of work-based learning, community college dual enrollment programs provide students with transitional opportunities to complete college credits in career and technical programs while in high school (Haag, 2015; Karp, 2015). As community colleges become dependent on dual enrolled students to slow declines in enrollment, it is suggested that institutions realign their resources to focus on college readiness and support for dual enrolled students (Jones, 2017; Thomson, 2017). Researchers suggested institutions and policymakers review practices and policies to broaden eligibility and expand participation to scale college readiness academic and non-academic skills for college success (An & Taylor, 2015). Challenges of community college dual enrollment program effectiveness continue to garner the attention of educators and researchers, yet there are promising outcomes for college readiness opportunities.

Although community college dual enrollment programs maintained significant growth in the number of high school students taking college courses, policies and practices have not evolved, which led to inequities in dual enrollment participation and educational outcomes (Pretlow & Patteson, 2015). Roach et al. (2015) interviewed a community action committee focused on remediating high dropout rates and identified fragmented dual enrollment policies related to admission testing, eligibility criteria, transportation, transfer of earned college credits to colleges and universities, and cost of attendance limiting positive outcomes for all students. Pretlow and Patteson (2015) and

Fletcher et al. (2018) discussed the importance of a shared understanding and cooperation in understanding college readiness to support policy development to enhance dual enrollment program outcomes and access. Unlike previously discussed long-term college outcomes such as retention, degree completion, academic performance, remediation, and academic momentum, this study furthers knowledge related to incremental academic achievement measures to understand program effectiveness and college readiness. Additionally, this study promotes exploration of data collection methods for student outcomes, specifically academic performance during dual enrollment programs to determine which core college disciplines most likely predict college readiness in the first year.

Perceptions of Dual Enrollment Programs

Students' Perceptions

Qualitative research studied students' perceived college readiness development based on their dual enrollment experiences and exposure to early college course content. Dual enrollment students reported development of college-going skills and social preparedness that contributed to their college readiness (Cowan & Goldhaber, 2015; Kanny, 2015; Lile et al., 2018). Dual enrollment students experienced implicit skill and college student identity development due to their college course completion through dual enrollment programs (Cowan & Goldhaber, 2015). Research suggested that dual enrollment students were more likely to self-identify as college students with increased awareness of faculty expectations to succeed in their courses (Lile et al., 2018). Dual enrollment students who took their college courses on campus reported their academic

independence and freedom from traditional high school structure which led to increased identification as college students (Kanny, 2015). Lile et al. (2018) study advances knowledge related to students gaining independence, which enabled increased responsibility for their academics and within their family context. Focus groups and interviews of dual enrollment students revealed the development of college-going skills and values such as increased self-awareness, responsibility, and independence (Lile et al., 2018; Peterson & Leonhardt, 2015). Student perceptions of dual enrollment programs affirm core goals to build academic knowledge, college-going identity and social skills required for the college transition in their first year.

Dual enrollment students shared both their academic and social perceptions on early college courses in high school that revealed lack of institutional, family, and personal support. Students expressed their exposure to rigorous course content helped them gain insight into regularly interacting with faculty to support success and readiness (Kanny, 2015; Allen, 2016). Dual enrollment participants expressed pride in getting to know different types of college students from diverse backgrounds and gained a deeper understanding of future careers and how college supported their goals (Lile et al., 2018; Allen, 2016). Braxton et al. (2000) examined social integration into campus norms and found that student perception of belonging supports learning in the classroom, overall commitment, and retention. Qualitative research describes students' perception of their academic development and social integration into college environment, but college readiness measures could expand and affirm their academic performance in college-entry courses.

Many states focus attention on dual enrollment eligibility criteria, funding, and enrollment, while institutions struggle to meet students' needs for learning support and educational services. Saenz and Combs (2015) found that students reported negative perceptions from family members who had to support them in fulfilling the dual enrollment participation obligation. Some dual enrollment students experienced a feeling of isolation due to challenging interactions with faculty and traditional college-student (Kanny, 2015). Dual enrollment students experienced a lack of support from both high school and college administrators while maintaining little access to support services such as tutoring and advising (Kanny, 2015). Support services were made available to dual enrollment students on campus, but these services were often provided during inconvenient times that reduced access for students in high school (Kanny, 2015; Allen, 2016). Garcia et al. (2020) and Lile et al. (2018) suggested increasing the number of dual enrollment students who participate on college campuses and strengthening high school counseling to ensure student needs are met for academic and social support. Dual enrollment students lack of access and support from college campuses and high schools may negatively impact their full potential to successfully prepare for their first year of college.

Curriculum alignment between secondary and postsecondary institutions providing dual enrollment is important to transferability of credits to their college of choice. Research studies suggest that inconsistent policies and state-wide governance for dual enrollment programs prohibit transferability of credits and alignment of secondary and postsecondary for seamless pathways to college (Pretlow & Patteson, 2015; Taylor,

2015; Zinth & Taylor, 2019). Dual enrollment students expressed fragmented college course requirements and misalignment between high school and colleges about specific college courses, resulting in harmful deficiencies (Kanny, 2015). Pretlow and Patteson (2015) examined two different states and suggested that statewide dual enrollment and transfer policies enable students' completion of transferable college credits more efficiently to any college in the state. The challenges in dual enrollment student experiences focus on the availability of support services, the impact of failed college courses on high school transcripts, and faculty support to address non-traditional college students' unique needs (Kanny, 2015). Collaboration between partnering secondary and postsecondary institutions should gather dual enrollment student experience data to improve access and support services specific to students' needs to facilitate program effectiveness and student success.

College Faculty Members' and High School Teachers' Perceptions

Although dual enrollment research suggested college courses and AP courses offered in high school increase curriculum rigor, there are challenges that the course content is not equivalent to college-level course requirements. Faculty teaching college courses to dual enrollment students provide support to demonstrate that college course content taught to high school students are rigorous and equivalent to traditional college content. Ferguson et al. (2015) examined faculty perceptions of course content equivalency and student performance in college courses taught in high school and found course content was equivalent or more challenging. Both Tensen (2018) and Ferguson et al. (2015) described teaching dual and concurrent enrollment programs as consistent or

more rigorous than traditional college course content. Dual credit course syllabi, assignments, and grading distributions were equivalent to ensure challenge for high school students (Ferguson et al., 2015). However, Garcia et al. (2020) surveyed the differences in dual credit programs and AP courses and found that AP courses were more rigorous. Despite challenges imposed by growth, varying policies, and inconsistent data availability, faculty and high school instructors confirm equivalency and rigor for early college content and exposure.

Dual enrollment program faculty provide students with early opportunities to understand faculty expectations for college-entry courses requiring ongoing professional development and training. Dual enrollment students reported a need for faculty support to address their non-traditional and unique needs (Kanny, 2015). As a result, both secondary and postsecondary institutions should strengthen collaboration to provide professional development for faculty and administrators (Conley, 2010a). Faculty and students shared similar perceptions about the students' benefit of gaining a better understanding of the course content, what is expected in college courses, and "hidden curriculum" such as faculty interaction (Kanny, 2015; Staats & Laster, 2018). Faculty described their commitment to dual and concurrent enrollment as requiring creativity, innovation, professional development, and collaboration with their community college faculty colleagues at the community college campus (Hanson et al., 2015). Research confirms dual enrollment college courses are rigorous and equivalent to traditional college courses requiring ongoing training and professional development to support teaching and learning effectiveness for high school students.

Dual credit program administrators report multiple benefits related to college readiness and share similar perceptions of students. Principals, teachers, and faculty shared similar levels of agreement that the dual and concurrent enrollment program positively improved their high schools by providing early exposure to academic content and skill development (Hanson et al., 2015). High school teachers reported increases in student performance that improved their preparedness both academically and personally for college (Ferguson et al., 2015). Credentialed high school teachers who taught college algebra in concurrent enrollment provided insight on improved student confidence to attend college due to challenging college-course content that better prepared students in a broader context (Staats & Laster, 2018). Dual enrollment faculty, administrators, and student share similar benefits of early college exposure, but there are challenges related to funding, support services, and curriculum alignment.

Superintendents', Counselors', and Advisors' Perceptions

Despite students benefitting academically, superintendents of public school systems shared concerns about dual credit programs related to funding, student performance, and teaching capacity. Hornbeck & Malin (2019) studied public school superintendents who expressed concern for the reduction of funds for retaining certified high school teachers who teach college courses; the inability to purchase textbooks to support dual enrollment programs; and the negative dual credit effect of students performing poorly in rigorous college courses. A financial review and analysis of 3 states providing dual enrollment programs identified inefficiencies suggesting greater financial burdens, rather than savings for the state's spending compared to advanced placement

(Rivera et al., 2019). Martinez et al. (2018) utilized a qualitative case study of high school superintendents and administrators who suggested the need to reinforce a college-going vision throughout the system, leverage resources to support long-term dual enrollment goals; and create a pipeline of master's degree prepared teachers to teach dual-credit college courses.

High school administrators understand the vital role dual enrollment programs played in educational attainment, while their apprehensions were associated with administrative barriers. Contrary to superintendents, counselors and advisors were more likely to express perceived benefits for students academically, but expressed operational concerns such as course selection, transcripts, student access to a support system, funding, and emotional intelligence (Hanson et al., 2015). In one study, counselors suggested that career and technical college course options motivated student exploration of career interests and provided undocumented citizens with access to college credits at no cost (Witkowsky & Clayton, 2020). Counselors shared a potential drawback of losing time for students who complete high school early that affect socialization and participation in traditional high school activities (Witkowsky & Clayton, 2020). Dual enrollment stakeholder perceptions represented both benefits and challenges related to administrative activities, funding, and transferability of college credits that meet high school and postsecondary requirements. Moreover, students' academic and social advancement due to early college exposure outweighed the concerns.

Dual Enrollment Benefits and Limitations

Dual enrollment programs facilitate academic momentum and social enrichment to engage students with college-going culture and academic content required for college and career readiness. Bowers et al. (2018) and Morgan et al. (2018) investigated the effects of increased high school rigor with AP and dual enrollment college courses and determined that they both lead to increased retention with academic performance being a contributing factor. Hunter and Wilson (2019) advanced retention research for dual enrollment students and found that first-time, full-time students who participated in dual enrollment programs retained at a higher rate of 76.2% compared to their counterparts who did not with 48.6%. Additionally, students who completed career and technical college courses during dual enrollment had higher retention rates (Hunter & Wilson, 2019). Fletcher et al. (2018) argued that integrating authentic career and technical experiences as part of dual enrollment programs enhance meaningful and relevant learning towards college and career readiness. Dual and concurrent enrollment programs advance college preparedness by motivating intentional career interests, continued college enrollment, and degree completion (Taylor et al., 2015). This study may expand data on how career and technical education earned college credits contribute to retention and college readiness measured by first-term GPA.

College retention rates are indicators of student momentum to successfully earn credits towards timely completion of degrees. Students who complete AP English and Math or dual enrollment credits have more college readiness as demonstrated by higher first-year retention rates (Bowers & Foley, 2018). Students who enrolled in college

during fall 2014 with dual enrollment credits had a higher retention rate of 87.2%

compared to 70.4% of enrolled students with no dual enrollment credits (Bowers &

Foley, 2018). Dual enrollment programs positively affect college student outcomes with

GPA being a contributing factor for completion, retention, and academic momentum

(Hunter & Wilson, 2019; Jones, 2014). Dual enrollment programs increase student

likelihood for retention with higher GPA as a contributing factor for college readiness

and degree completion outcomes.

Dual enrollment participants increase their likelihood of completing degrees in a

shorter time, enrolling in subsequent semester, and reducing their need for remediation

and financial burden. Cowan and Goldhaber (2015) suggested that dual credit programs

enhance college selection by creating better matching between students and college,

while reducing college attendance costs. Dual enrollment programs provided students

with academic momentum demonstrated through increased academic performance,

college enrollment immediately following high school, and higher attempted credits

(Wang et al., 2015). Students who participated in dual enrollment programs were less

likely to require remediation and 2.5 times more likely to complete a 2-year degree

within a reduced time of two years (Burns et al., 2018; Grubb et al., 2017). Research

suggests that dual enrollment programs have a cumulative effect on long-term student

outcomes (Edmunds et al., 2020; Grubb et al., 2017). This study may broaden

understanding of early outcomes during dual enrollment to expand knowledge related to

college readiness in the first enrolled year.

Dual enrollment programs result in both positive and negative outcomes related to student academic and non-academic experiences. Although high school students who completed college courses increased their likelihood to enroll in college and complete degrees, some students dropped out or completed a GED instead of their high school diploma (Cowan & Goldhaber, 2015). Kremer (2020) investigated remedial course-taking patterns of former dual enrollment students with low socioeconomic status and revealed a need for remediation despite early college exposure. Dual enrollment students were less likely to complete the associate's degree than those who did not at their host community college (Lawrence & King, 2019). Kanny (2015) studied dual enrolled student perceptions and discovered students were earning lower grades in their high school courses than non-participants. Understanding key advantages and disadvantages of dual enrollment programs contribution to student experiences and outcomes are essential for program evaluation and improvement planning.

Dual Enrollment Governance and Policies

Dual and concurrent enrollment programs are governed by each individual state to ensure guidance for eligibility, teaching credentials, cost of attendance, curriculum, and data reporting requirements. Dual and concurrent enrollment programs are offered by many states with varying policies and accrediting bodies resulting in inconsistencies in collecting data to measure college readiness and access for all students (Zinth & Taylor, 2019). Taylor et al. (2015) examined policy dimensions to include program eligibility, articulated college credit, financial burden, data collection, and incentivization, which determined a lack of emphasis on quality control and increased policy variations. State

policies focus on funding, student eligibility, and overall enrollment in dual enrollment programs limiting consistent data and information collection to determine program effectiveness and student outcomes. Localized state governance furthers misalignment in curriculum and data collection essential to evaluate student performance and college readiness.

Variation in localized policies across each state hinders clarity and consistency for early college programs and initiatives curriculum and protocols for evaluation. Centralized state policies that govern dual enrollment programs establish clarity and consistency for defining college courses, transferability of credits, regulation of tuition costs, and collection of comprehensive measures to ensure curriculum alignment and access for all students (Pretlow & Patteson, 2015). ACT (2015) reported a need for federal and state policymakers to evaluate challenges related to who has access to dual credits in high school and how dual enrollment programs are assessed to achieve its goals. Student participation in dual credit options continues to expand with little focus on governing policy improvement (Pretlow & Patteson, 2015). Limited policy research to inform improvement emphasizes concern for governance capacity to measure overall program effectiveness in preparing students for college enrollment without the need for remediation (Taylor et al., 2015). Federal policy guidance and reporting provisions for dual enrollment programs may facilitate a centralized definition of college readiness with clear measures for program evaluation and student outcome metrics.

Michigan Dual Enrollment Policy and Governance

The Postsecondary Enrollment Options Act of 1996 (Public Act 160) and the Career and Technical Preparation Act of 2000 (Public Act 258) are the legislative acts that govern and support dual enrollment participation and eligibility in Michigan. These regulations outline eligibility requirements for students, high school districts, course content and college enrollment of dual enrolled students (Postsecondary Enrollment Options Act, 1996; Career and Technical Preparation Act, 2000). The Michigan Department of Education are required to monitor institutional data collection for dual enrollment programs and submit annual enrollment and budget summaries to Senate Fiscal Agencies. The Michigan Department reporting and data collection requirements are focused on dual enrollment program spending, enrollment of dual enrollment students who received payment, and the number of college courses offered by the postsecondary institution. The reporting requirements for the Michigan Department of Education are related to budgetary requirements limiting consistent reporting on college readiness indicators and overall program effectiveness. Without clear provisions for dual enrollment student outcomes reporting requirements for Michigan colleges, each institution is responsible for implementing internal assessments and evaluation to inform planning and program improvement.

Michigan legislation governs dual enrollment program delivery requirements , but there are limited quality control provisions related to college readiness and student outcomes. The Michigan Department of Education utilizes the MI School Data agency to collect and report statistics for Michigan dual enrollment students. The MI School Data

source is a third party that publishes the College Opportunities for High School Students

report on their website, which includes dual and early college program participation data,

high school graduation rates, partnering community colleges program enrollment, and

bachelor's degree completion (MI School Data, n.d.). According to the 2020-21 MI

School Data College Opportunities for High School Students (MI School Data, n.d.)

report, approximately 3.7% (18,735) of eligible high school students participate in dual

enrollment and earned 188,074 college credits. There was an increase in the number of

schools that participate and offer dual enrollment programs from 740 in 2015-16 to 794

in 2020-21 (MI School Data, n.d.). Dual enrollment program student outcomes related to

completion of bachelor's degrees and academic momentum resulted in 29.4% who earned

a bachelor's degree and 16.5% who earned a minimum of 24 college credits while in high

school. The MI School Data report for dual enrollment included enrollment and college

credits earned trends, but excluded associate's degree earners and college readiness

outcomes while in the program. Limited data and reports associated with incremental

dual enrollment program inputs, outputs and student performance prevents an overall

understanding of Michigan early college initiative impact. This study investigated the

number credits earned in best practices courses and its relationship to the first-term GPA

to predict college readiness and inform dual enrollment program evaluation.

Dual and Concurrent Program Accreditation

Dual enrollment programs are evaluated through regional and state-wide

standards for accreditation to ensure curriculum integrity, equivalency, and teaching

effectiveness. Although state and federal policies do not require specialized dual

enrollment accreditation, the National Alliance of Concurrent Enrollment Partnerships (NACEP) is a voluntary accreditation sought by institutions to increase dual enrollment participation and affirm program quality and effectiveness (Taylor et al., 2015). Although state policy governance is required to monitor quality standards for dual credit programs, research suggests significant variation in policies and limited focus on student outcomes (Higher Learning Commission, 2013; Taylor et al., 2015) The voluntary NACEP affirms and accredits dual enrollment standards related to instructional delivery, faculty professional development, student outcomes assessment, curriculum rigor, and acceptable practices that ensure consistency and accountability (Scheffel et al., 2015). Colleges are not required to maintain specialized dual enrollment accreditation, but must demonstrate that it meets required guidelines and standards outlined by their regional accrediting body required by their governing state.

Regional accreditation agencies serve in a quality assurance capacity by affirming the institutions practices and policies support quality educational programs and supportive services. Institutional accreditation is required for federally-funded colleges to affirm ethical responsibility, quality standards of education and support services, but there are limitations related to specific outcome measures to evaluate dual credit programs (Higher Learning Commission, 2013; Taylor et al., 2015). Regional accreditation is required to evaluate dual and concurrent program policies and curriculum equivalence as part of comprehensive quality assurance for the institution and have increased quality provisions for student outcomes (Higher Learning Commission, 2013). State policies alone are inadequate requirements for dual and concurrent enrollment

accreditation that inhibit annual reporting on student outcomes data that could inform governing policy improvements (Taylor et al., 2015). The Higher Learning Commission conducted a study on dual enrollment program policies initiating a call to broaden policy improvements to minimize issues with access, quality, curriculum rigor, credit transferability, evaluation of outcomes, and collaboration between secondary and postsecondary (Higher Learning Commission, 2013). Broadening voluntary and federally- required accreditation standards are important to maintain quality assurance measures for dual and concurrent program learning and teaching effectiveness dedicated to college readiness and student success.

Dual Enrollment Policy and Structural Deficiencies

Dual enrollment policies have not evolved to meet the changes and programmatic demands for student success and college readiness reform. Research on dual enrollment policy focused on accessibility and student long-term outcomes, while program effectiveness and accountability remain fragmented due to inconsistent governance and organizational structure (Taylor, 2015). Investigation of dual-credit policies and stakeholders revealed challenges with transferability of credits to colleges and universities due to limitations in statewide transferability and credit articulation requirements (Myers & Myers, 2017). Taylor et al. (2015) analyzed dual enrollment program quality standards and policies and found inadequate state-wide policies for course transferability, suggesting a need to reduce accessibility barriers, program quality standards, and transferability of dual-credits. Research findings revealed that community colleges should examine existing state and accrediting policies to identify areas for

improvement in transferability, dual-credit modalities, faculty credentials, and support

services to meet the quality standards required by accrediting bodies and governing states

(Taylor et al., 2015). Further research on federal regulations and student outcomes data

collection to inform program evaluation of college readiness reform initiatives may

advance student success and timely completion of degrees.

Variations in state-wide policies for dual enrollment programs inadequately

address program accessibility and consistent data collection to promote college readiness

for all students. Policy research for dual and concurrent enrollment identified inequities

for access, eligibility, variation in statewide policies, and lack of data and information to

measure program effectiveness and college readiness (Higher Learning Commission,

2013; Pretlow & Patteson, 2015). Although most high school students demonstrated

positive outcomes in dual enrollment programs, there are lesser effects with access and

achievement for minority students and low economic status families (Taylor, 2015). Dual

enrollment students were less likely to require remediation coursework overall, but

minority and low socioeconomic status students demonstrated a strong relationship with

taking remediation courses upon college entry (Kremer, 2020). Broadening data

collection for underrepresented communities and their academic performance in dual

enrollment may inform program improvement to promote inclusion and readiness for all.

The lack of consistent policy requirements for dual enrollment programs hinder

data-informed provisions and requirements to improve college readiness, college

outcomes and alignment between secondary and postsecondary curriculum. As the gap

for higher education attainment widens for meeting the workforce's needs, the

government focuses its reform on completing degrees (Karp, 2015). Higher education reform focused on dual enrollment to advance accessibility to underrepresented communities, increase smoother transitions to college, improve college readiness, and strengthen collaboration between secondary and postsecondary to promote degree completion (Mitchell, 2009). Policy organization and structure research revealed inconsistencies across governing states and institutions that led to barriers to dual enrollment accessibility, funding, and transferability of credits that impede reform of degree completion and college readiness (Kremer, 2020). Pretlow and Patteson (2015) investigated dual enrollment programs in two states and recommended policy improvements to provide a centralized plan to clarify dual enrollment definitions and requirements aimed at admission, transferability of college credits, and accountability to evaluate program effectiveness. Federal guidance and oversight for institutions of higher education related to college readiness metrics, student outcomes, and reporting standards for early college programs may inform reform initiative planning and effectiveness.

There are limitations in collaborative partnership dynamics, transferability of courses and consistent data collection protocols to inform reform related to curriculum alignment, student outcomes, and program improvement. Research on dual enrollment educators and practices identified concerns with power dynamics between high school and college personnel and high school policies that countered the incentives for students who participated in dual enrollment programs (Howley et al., 2013). Research suggested a need for refined dual enrollment data collection to guide policy reform and improvement (Grubb et al., 2017; Thomson, 2017; Zinth & Taylor, 2019). In addition,

there are limitations in data collection systems that enhance the evaluation of dual

enrollment programs to advance the measurement of program effectiveness and inform

state leaders and policymakers (Zinth & Taylor, 2019). Thomson (2017) proposed that

limited statistics shifted dual enrollment goals from core academic readiness to access,

costs, and reduced time to degree completion impeding educators and policymakers

understanding of dual enrollment program effectiveness. Moreover, policies focused on

data collection and access could better inform policy and practice improvement to reduce

the achievement gap (Roach et al., 2015).State-led dual enrollment governance and

policy variation inadvertently alter quality assurance and data collection consistency to

monitor college readiness, program effectiveness, and student outcomes.

Summary and Conclusions

Current literature described dual and concurrent programs' role in college

readiness and education reform with empirical knowledge on positive postsecondary

outcomes. Dual enrollment programs have a cumulative effect on college enrollment,

retention, and degree completion (Morgan et al., 2018). Yet, it is unclear how earned

college credits during dual enrollment relates to intermediate postsecondary outcomes to

provide insight for data collection needs, policy reform, and program improvement.

Despite the growth in the number of students taking college credits in high school, policy

improvements and quality assurance measures for accountability have not kept pace with

the increased capacity. As a result, existing dual enrollment policies and institutional

practices may unintentionally hinder access, curriculum alignment, and college readiness

outcomes. Due to inconsistent state policy that govern dual enrollment, there are

continued issues with curriculum alignment, credit transferability, and support for dual enrollment students. Stronger collaboration and alignment of secondary and postsecondary to develop a shared vision for college readiness and data collection could broaden the measurement of preparedness and dual enrollment program effectiveness (Karp, 2015). Literature suggested further investigation of policy development and enforcement, provisions for data collection, and more inclusive measures of college readiness (Zinth & Taylor, 2019). This study advances knowledge and data on how discipline-specific college credits earned during dual enrollment programs relate to college readiness measured by first-term college GPA in the first year for community colleges.

Chapter 3: Research Method

Introduction

The purpose of this quantitative study was to examine the extent of the relationship between the number of college credits earned in general education, career and technical, and community college orientation courses completed by former dual enrollment students and their first-term grade point average (GPA) in their first year. This study broadens existing literature by providing empirical data on former dual enrollment students' early college credit attainment to determine which best practice discipline credits may predict GPA in students' first year of college as a measure of college readiness. The findings from this study may help community college leaders to develop a dual enrollment curriculum to integrate specific college courses and credits that are more likely to relate to college readiness. The research findings may help leaders to define program outcome metrics and advance quality measures for policy and program improvement. In this chapter, I provide details on the research design, rationale, and methodology; sample and setting; data collection and analysis plan; and validity and ethical procedures.

Research Design and Rationale

As part of the study's nonexperimental, quantitative research design, I used regression analysis to examine the extent of the relationship between the number of college credits earned by former dual enrollment students in general education, career and technical education, and community college orientation courses and their first-term community college GPA in their first year of college. The regression analysis involved

both a multiple linear regression and a series of simple linear regression to summarize overall model fit, measure the strength and direction of the relationship, and explain how the predictor variables including the number of college credits earned by former dual enrollment students in (a) general education, (b) career and technical education, and (c) community college orientation courses individually and collectively contribute unit change and to what extent they predict first-term community college GPA. The criterion variable, first-term college GPA, was the numeric calculation of the students' GPA according to the partnering Michigan community college's established grading system policy.

Researchers who use a quantitative research gather numeric data on topics of interest for the purpose of prediction, observation of relationships between data, testing of a phenomena, and measurement of change to extend empirical knowledge (M. Allen, 2017; Burkholder et al., 2016). I used a causal-comparative design to explore how dual enrollment program college course-taking patterns produce change in academic performance measured by GPA. A causal-comparative design is used to examine a relationship between independent and dependent variables after an activity or event to compare its effect on two or more groups (Burkholder et al., 2016). I used regression analysis to further explain how the predictors estimated change and the extent to which they predicted the criterion variable. Researchers use regression analysis to explain the relationship between one or more measurable predictors and one criterion variable (Burkholder et al., 2016; Schroeder et al., 2017b). Regression analysis allows the researcher to estimate the strength of the predictive relationship and determine which

variables predicts variation in the criterion variable (Byrne, 2017). Examining the relationship between each discipline and the first-term GPA collectively and individually described how earned discipline-specific college credits contributes change and predicts academic performance as a measure of college readiness.

I used an observational approach to predict how early college credits earned in core disciplines during dual enrollment relate to college readiness according to observed academic performance. An observational approach explains how the predictors and criterion variable are related to predict the variation in the outcome variable (see Edmonds & Kennedy, 2020). In this study, I used regression analysis to predict change in the first year GPA of community college and examine the extent of college readiness for former dual enrollment students. Quantitative educational researchers study phenomena to measure the strength and direction of relationships of various factors associated with student learning and motivation (Cohen et al., 2017). The observational approach for the research design may expand data on the relationship between earned college credits in dual enrollment and the extent it predicts academic performance.

Burkholder et al. (2016) suggested that regression analysis is used in nonexperimental studies to examine the linear relationships between one or more predictors and a criterion variable that occurred in the past. In this study, I used archival data collected from a Michigan community college data information system. Using archival data yielded a large sample and met the data quality standards established by the community college. The data on former dual enrollment students remained unchanged and limited to available credit history for the students' academic history from 2017 to

2020. The archival data were dependent on availability and the institution's business rules for extraction from the information management system.

Methodology

This quantitative research study was nonexperimental and involved regression analysis of numeric archival transcript data collected from a Michigan community college. By using a nonexperimental design featuring regression analysis, a researcher can observe a relationship or variation in variables, which may allow them to predict how a unit change positively or negatively affects the criterion variable (Schroeder et al., 2017b). A quantitative, regression analysis approach cannot be used to determine causation between predictors, the criterion, or unexplained variables in the study (Burkholder et al., 2016). The use of regression analysis did not determine causation between the number of college credits earned by former dual enrollments in each discipline and first-term college GPA; however, it allowed me to explain the extent of an observed relationship with the criterion variable based on a unit change in the predictors (see Schroeder et al., 2017b). The study used a representative convenience sample of 524 former dual enrollment students who enrolled in the partnering Michigan community college for the first time following high school graduation.

Population

The study utilized archival data from a partnering Michigan community college. The community college is located in Michigan and is one of 28 community colleges statewide. The dual enrollment program provides college courses taught on the college campus and concurrently at the partnering high school taught by certified college faculty.

The dual enrollment program does not provide courses to high school students online. This community college was selected because it provides one of the larger dual enrollment programs serving multiple partnering school districts in the state. Moreover, Michigan is where statewide quality provisions and policies for evaluating dual enrollment student outcomes are less prevalent and monitored by the internal college administration (Higher Learning Commission, 2013). The size of the dual enrollment program aided in the collection of a larger sample size representative of similar dual enrollment programs and community colleges.

The dual enrollment program provides early college credits in general education, career and technical education, and community college orientation courses. There are 26 school districts served by the community college dual enrollment program only on campus and at the partnering high school to develop curriculum content according to governing policy and agreement. The former dual enrollment students who subsequently attended the community college were admitted as first-time, first-year college students. Due to the COVID-19 pandemic, there was no dual enrollment offered during 2019 and 2020. As a result, student access to college courses was prohibited decreasing the number of dual enrollment students who enrolled for the first-time during the program suspension.

The population comprised of former dual enrollment students who completed at least one community college course while in high school and enrolled at the partnering community college with no previous college courses from other colleges. The target sample comprised of 524 former dual enrollment students who enrolled in their first year

of college at a partnering community college for the first time with a high school

diploma. High school students may earn college credits during dual enrollment programs

in Michigan beginning in the 9th grade through 12th grade. Therefore, dual enrollment

students who earn college credits may be 14 years or older. The population was

representative of former dual enrollment students who enrolled at the partnering

community college in at least one fall, spring, or summer semesters during 2017 to 2020

academic years.

Sampling and Sampling Procedures

A convenience sample is a non-probabilistic sampling procedure comprised of

archival data representative of student transcript history who enrolled in the partnering

community college. The archival data sampling procedure were selected based on

availability and representation of dual enrollment student historical course-taking actions,

units, and performance used for administrative, operational, and research purposes.

Burkholder et al. (2016) suggested convenience sampling are used in educational and

social research as a feasibility strategy related to time costs, and larger sample potential.

The sample was dependent on data exported by the community college database

administrator according to the institution's business rules for the Ellucian Banner ERP

information system, which may have missing or incomplete student records data.

Burkholder et al. (2016) suggested convenience samples are dependent on availability of

data and may present limitations for explanation of representativeness to broader

populations. The advantage of using archival data for the study enabled access to a larger

sample of former dual enrollment students and feasibility due to limited time and cost

constraints. Although the sample is representative of the colleges' dual enrollment program population, generalizability is limited with details discussed further in the chapter.

I used a convenience sample of archival data exported from the college information management system for former dual enrollment students who subsequently enrolled in the partnering Michigan community college after high school graduation. Following discussion of available data in the information management system, the college did not have access to high school student transcript information. The sample included students who participated in the community college dual enrollment program and completed their high school diploma; enrolled in at least one college credit at the partnering college for the first time during the fall, spring, or summer semesters during 2017 to 2020, with no previous enrollment or college credits from another college. The sample excluded former dual enrollment students who did not graduate from high school, earned a GED, or attended another college prior to the community college.

The sample included archived transcript and enrollment data collected from historical records that manage and record academic history at the institution. Secondary data refers to a data set collected by another entity for administrative purposes and enables further analysis to explain the existence and strength of relationships between specified factors of interest (Hakim, 2012). Discussions with the information technology database administrator was important to gain clarity and understanding of data variable definitions and availability, how data is processed and imported into databases for analysis. This discussion was important for preparations for Institutional Review Board

(IRB) approval and expediting the institution's data request process for timely collection of accurate data. The study was dependent on existing data used for administrative purposes that was not manipulated or changed for research analysis.

A letter of cooperation provided consent by the community college in support of data collection and research on former dual enrollment students' transcript data. I scheduled a meeting with the database administrator from the community college to discuss data availability and criteria for the requested sample data. The letter of cooperation outlined a brief description of the study, how the research data will be used and safeguarded, and guidance for collecting the sample. Upon approval of the letter of cooperation, the appropriate IRB applications and forms were completed and submitted for IRB approval. Upon IRB approval, the data request was completed and submitted to specify file formatting and inclusion and exclusion criteria for the sample.

I requested data for former dual enrollment students who enrolled according to discussions with institution. Upon request for GPA for former dual enrollment students, it was discovered that first-year GPA was not available or archived in the data management system and would have to be a calculated variable. As a result, the data request was modified to collect the first-term GPA in their first year of college. The variables were imported into an Excel database to include the fall, spring, summer semesters for former dual enrollment students who enrolled for the first time, total number of earned college credits during dual enrollment, number of credits earned during in career and technical education, general education, and community college orientation courses, and their first-term GPA their first enrolled year. The requested data excluded former dual enrollment

students who earned college credits from another college prior to enrollment at the

selected community college; withdrew or received incomplete grades for all dual

enrollment college courses; withdrew or dropped all dual enrollment college courses.

The sample size collected was 524 former dual enrollment students, which

exceeded the calculated minimum sample size of 77 based on the statistical power

analysis conducted using the G*Power 3.1 software application (see Appendix A). The

statistical power analysis equation was based on an a priori calculation for a multiple

linear regression statistical test for a total of three predictors equation (Faul et al., 2009).

The power analysis used the recommended medium effect size ($f_2 = .15$) testing statistical

significance with an exceeding the minimum sample size calculated by the G*Power

analysis to analyze an effect in the relationship between the predictors and criterion

variables. Upon receipt of the Excel file with requested data, the sample was screened to

identify discrepancies and outliers that would violate the sample criteria and statistical

assumptions for regression analysis. The data were cleaned to remove incomplete cases

to prevent outliers that may disrupt the overall statistical analysis.

The sample was exported from the information management system to an Excel

database according to the requested sample criteria. The transcript data included five

variables: the total number of earned college credits in dual enrollment, the number of

earned credits in general education, the number of earned college credits in career and

technical education, the number of earned college credits in community college

orientation courses, and the first-term community college GPA. The sample was

representative of former dual enrollment student population who attended their first year
of college at the partnering community college.

Instrumentation and Operationalization of Variables

The predictors and criterion variable were aligned to the theoretical framework
and prevalent measures established by the Institute of Education Statistics (2016) to
measure postsecondary reform initiatives. The quantitative research design used
regression analysis to explain the relationship between three predictors and one criterion
variable that were continuous, not manipulated, and measurable on a ratio scale. The
three predictors are the number of earned college credits by former dual enrollment
students during high school in (a) general education, (b) career and technical education,
and (c) community college orientation courses who enrolled in the partnering community
college for the first-time during 2017 to 2020. The criterion variable is the first-term GPA
for former dual enrollment students who enrolled in the partnering community college
and attempted at least one college credit in their first year of college during 2017 to 2020.
The regression analysis described to what extent the predictors contributed unit change as
well as predict the criterion variable. The predictors and criterion variable are described
to demonstrate alignment with the theoretical framework and quantitative research design
using regression analysis.

The variables were selected based on Conley's (2010a) key dimensions of college
and career readiness model that outlined entry-level college knowledge and best practice
courses in entry-level career and general education that lead to college success. Conley
outlines the most prevalent approach to determine college readiness is measuring

students' course-taking patterns, units, and academic performance in high school. The three predictor variables represent the discipline-specific college course titles earned during high school. The earned college credits by former dual enrollment students in specified college-entry courses are aligned with the two primary academic dimensions, content knowledge and cognitive strategies. Conley's college and career readiness model proposes that the number and type of course units a student takes in high school are fundamental determinants for college readiness measured by their academic performance. The first-term college GPA in their first year of college was selected to align with the best practice strategy for measuring student academic readiness for college while in high school (Conley, 2010a). Former dual enrollment students who successfully earned college credits in core subjects in high school may demonstrate academic preparedness based on their letter grades and respective grade points awarded by the college faculty.

The first-term GPA for former dual enrollment students who completed at least one college credit in general education, career and technical education, and community college orientation courses helped explain how early college course-taking credits relate to college readiness measured by academic performance. College GPA is a common determinant for academic performance used to evaluate higher education intervention initiatives (Institute of Education Statistics, 2016). Conley's college and career readiness model suggested that fundamental factors in measuring college readiness depends on the combination of the course titles, number of units in college-entry courses and academic performance measured by GPA to determine for college success. The criterion variable of first-term GPA is aligned with the fundamental determinants for measuring college

readiness. The study variables were selected and grounded in the Conley's college and career readiness theoretical framework focused primarily on the key academic content dimensions.

The predictor variables are based on the institution's established credit assignment policy that defines a numeric value for college courses according to the amount of instructional time required to achieve the learning outcomes for each course. The number of college credits assigned for each course are outlined in the institution's established catalog of requirements for each degree or certificate program. The academic history for dual enrollment participants and those who enroll as community college students include course titles, attempted and earned credit hours, letter grades for courses completed, and calculated GPA are generated in the community college information system according to catalog and policies established by the college.

The three predictor variables were continuous in nature. I analyzed the number of credits in these courses in relation to first-term community college GPA to measure college readiness. The predictor variables were not manipulated and represented the number of earned college credits according to their awarded grades for each completed college course in general education, career and technical education, and community college orientation courses during dual enrollment. These predictors are measured on a ratio scale, where zero represents the absence of earned credits as a result of receiving an "E" grade. Students who do not attempt credits in any or all disciplines will be coded "999" as missing or NA to differentiate between "0" numeric values for earned credits and first-year GPA. The number of earned college credits by former dual enrollment

students are organized according to the institution's established discipline definition. Therefore, each predictor variable represents the accumulated number of earned credits from multiple courses specified by the institution's definition for each discipline.

The criterion variable first-term college GPA is continuous and measurable on a ratio scale to quantify academic performance in the first-year at the partnering community college. The first-term GPA is based on the community college's numeric value calculated by the college information system according to the established GPA equation policy. The calculation for GPA is outlined in the college catalog as the total grade points earned according to the awarded letter grade, multiplied by the assigned number of credits for the course, and divided by the total number of attempted college credits in the first year of college. For example, a former dual enrollment student who completed three courses in their first year of community college to include a three-credit English 102 with an A, three-credit Math 104 with a C, and two-credit History 106 with a B would have a GPA calculation as follows: English 102- (4x3)=12 grade points, Math 104-(2X3)=6 grade points, History 106-(3x2)=6 grade points. The GPA calculation equation results include 24 earned grade points divided by 8 attempted credits equals a 3.0 GPA. If a student is awarded an "E" letter grade, the student would receive zero grade points for the completed course.

The community college's grading system is based on grade points earned according to the letter grades awarded by the faculty on a four-point scale and the number of assigned credits for the course. The community college's grading system is a scale of letter grades and associated grade points, with A = 4.0, B = 3.0, C = 2.0, D = 1.0, and E =

0.0; it is used by college faculty to award grades based on student academic performance in the courses. Students who receive letter grades of A, B, C, or D will earn the assigned number of credits and grade points for the completed course. For example, a student who received an E letter grade in a three-credit course will earn zero credits and no grade points for the completed college course. Grade points are numeric values used to by the information system to calculate GPA for enrolled students at the community college.

The predictors and criterion variables utilize the same four-point grading system. The first-term GPA is a calculated variable based on academic performance and credit value assignment for each course completed in the first year of community college. The variables are consistent with the institution's established policies for assigning grades and calculation of GPA for completed college courses during dual enrollment. The data collected from the community college information system provided the total credits earned according to defined disciplines and the calculated GPA numeric value for former dual enrollment students in their first year in the community college. For the purposes of the study, academic performance is based on a calculated first-term GPA and served as a measure to determine what extent discipline-specific credits in dual enrollment predict college readiness.

Data Analysis Plan

I used regression analysis to explore the association between the number of college credits earned by former dual enrollment participants in three core discipline course areas and their first-term GPA as a determinant of college readiness. The following overarching RQ informed the data analysis plan: To what extent does the

number of college credits earned during dual enrollment in general education, career and technical education, and college readiness courses predict GPA in the first year of community college? The association between the number of earned college credits in (a) general education, (b) career and technical education, and (c) community college orientation courses during dual enrollment and first-term GPA in community college was explored using both simple linear regression and multiple linear regression to the test the following hypotheses:

$H_0 1$: There is no statistically significant relationship between the number of college credits earned in general education, the number of college credits earned in career and technical education, the number of college credits earned in community college orientation courses by dual enrollment participants, and first-term college GPA in community college.

$H_a 1$: There is a statistically significant relationship between the number of college credits earned in general education, the number of college credits earned in career and technical education, the number of college credits earned in community college orientation courses by dual enrollment participants, and first-term college GPA in community college.

$H_0 2$: There is no statistically significant relationship between the number of college credits earned in general education courses by dual enrollment participants and first-term college GPA in community college.

H_a2: There is a statistically significant relationship between the number of college credits earned in general education courses by dual enrollment participants and first-term college GPA in community college.

H_03: There is no statistically significant relationship between the number of college credits earned in career and technical education courses by dual enrollment participants and first-term college GPA in community college.

H_a3: There is a statistically significant relationship between the number of college credits earned in career and technical education courses by dual enrollment participants and first-term college GPA in community college.

H_04: There is no statistically significant relationship between the number of college credits earned in community college orientation courses by dual enrollment participants and first-term college GPA in community college.

H_a4: There is a statistically significant relationship between the number of college credits earned in community college orientation courses by dual enrollment participants and first-term college GPA in community college.

I used multiple linear regression statistical analysis to summarize the overall model fit and describe variation of the criterion variable based on predictors positive or negative contribution to unit change in the first-term GPA. A multiple linear regression statistical test measures how two more predictor variables explains and predicts variation in the criterion variable (Schroeder et al., 2018). The statistical test will analyze the observed variation in the criterion due to predictors simultaneous and individual contribution, while controlling for each predictor (Schroeder et al., 2018). Schroeder et

al. (2017b) suggested that multiple linear regression analysis is guided by how multiple factors that are aligned to theory advance knowledge by simultaneously examining several predictors and how it estimates change in the criterion variable. The multiple linear regression statistical analysis will test H_01 to examine overall significance of the model to determine how credits earned in each discipline contribute variation in the first-term GPA to measure college readiness.

I used individual simple linear regressions to expand and characterize the strength and direction of the relationship and to what extent credits earned in each discipline predicts first-term GPA. Simple linear regression provides explanatory statistical analysis of the association between an individual predictor and criterion to estimate and predict the effect of one variable on another (Schroeder et al., 2017b). Linear regression is used to explain a linear relationship and goodness of fit of a model between an individual predictor and criterion to estimate change or forecast an effect in an outcome (Warner, 2013). Simple linear regression may be conducted using quantitative or dichotomous variables to explain the extent of the association, determine the strength and direction of the relationship to predict unit change in the dependent variable (Schroeder et al., 2017b). Simple linear regression analysis was selected for its measure of estimated prediction values, correlation, strength and direction of relationship between each individual predictor and criterion variable.

In addition to the regression statistical tests, the Pearson correlation coefficient (r) and confidence intervals were used to further characterize the extent of predictive relationship. The Pearson's r determines the strength and direction of the linear

relationship between each variable. The confidence interval calculated the mean range to predict unit change in the first-term GPA with 95% confidence. These statics were used to further describe the correlation and linear relationship between each pair of predictors and criterion variable.

Following IRB approval, I imported the Excel data file into the IBM SPSS Statistics predictive analytics software to define the measurement scales, label and code the variables, and clean the data in preparation for analysis. The prescreening process is important in the beginning of the process to examine outliers, missing data elements and code null cases to minimize the effect of outliers and interference with statistical analysis assumptions (Warner, 2013). The data set was examined for null values to include missing GPA and number of earned credits for general education, career and technical education, and college orientation. Null cases were considered missing values of former dual enrollment students who did not attempt credits in one or more of the core disciplines or have a missing first-term GPA. Null cases were coded as missing values with "999" in the data file. Coding missing cases with "999" for these variables differentiated between students who have earned a value "0" for credits in one or more core disciplines or a "0" calculated first-term GPA from students who did not attempt credits in any of the core disciplines or have a missing first-term GPA. The null cases were coded missing to reduce outliers in the data set and minimize issues of linearity and homogeneity.

The data set were tested to verify the assumptions required for both statistical analyses to determine conclusions associated with using multiple linear regression and

simple linear regression statistical analysis. The data were tested for normal distribution, linearity, multicollinearity, and homoscedasticity, which verified assumptions for both multiple linear regression and simple linear regression analyses. Normal distribution is used to determine if there are any outliers and whether the values of the criterion variable are normally distributed in the shape of a bell curve (Warner, 2013). Linearity is tested to determine if the relationship between the predictors and the criterion variables are linear (Warner, 2013). Multicollinearity is used to determine if there are highly correlated interactions between the variables, which violates the assumptions needed for multiple linear regression statistical analysis (Warner, 2013). Multicollinearity presents an issue for drawing conclusions from the analysis due to the inability to discern which of the predictors is contributing to the variation in the criterion variable (Schroeder et al., 2017a). Homoscedasticity is tested to determine whether the variance demonstrates uniformity of residuals measured between the predictors and criterion across the sample of data (Warner, 2013). Homoscedasticity assumes a good model fit for determining variation across the sample of data. Assumption testing was conducted and verified to determine if there were any violations. Appropriate testing was conducted to resolve any violations and determined the data met assumption requirements for the statistical test.

The statistical assumptions were tested by graphing scatterplots with fit lines to verify linearity, homoscedasticity, and a histogram for determining reasonable normal distribution using IBM SPSS statistics predictive analytics software. If there are any violations of linearity, homoscedasticity, or normal distribution, bootstrapping of the data will be considered to statistically correct for confidence intervals. Multicollinearity was

tested by conducting correlation diagnostics with the variance inflation factor (VIF) value for each predictor variable to determine if there are any interactions causing interference with estimate coefficients. The correlation VIF statistic was used to test and explain any interaction between the predictor variables that may contribute potential change in the criterion due to other factors. In the event the VIF indicates issues with multicollinearity, a correlation matrix will determine which variable(s) should be removed from the equation. Assumptions of linearity, homoscedasticity, and homogeneity were examined by reviewing the scatterplots of the residuals and the normal P-P plot. If the assumptions are violated, bootstrapping with a sample size of 1,000 will be conducted to provide statistically corrected 95% confidence intervals. Upon verification of assumptions, the data met the requirements to conduct the regression statistical analysis.

Upon completion of data cleansing, pre-screening and assumption testing, descriptive statistics summarized sample distribution, means, and standard deviations for each metric variable to provide context for the sample population. Descriptive statistics characterized the sample by aggregating the data into useful information about former dual enrollment participants credit history and academic performance. The descriptive measurements of the sample distribution summarized trends and patterns of the former dual enrollment students' academic history and performance in their first year at the Michigan community college.

I performed multiple linear regression statistical analysis to test the first null hypothesis to explain the relationship between the former dual enrollment students' number of earned college credits in (a) general education, (b) career and technical

education, and (c) community college orientation courses and first-term GPA in community college. H_01 stated that there is no statistically significant relationship between the number of college credits earned in general education, the number of college credits earned in career and technical education, the number of college credits earned in community college orientation courses by dual enrollment participants, and first-term college GPA in community college. The multiple linear regression statistical analysis best suits this study by determining how multiple predictors contribute to the change in the first-term GPA concurrently, while accounting for the effects of each individual predictor. Multiple linear regression estimated the model fit for the predictors and criterion variable while measuring which predictor contributes the strongest variation in first-term GPA as a determinant of college readiness.

I used the linear regression analysis statistical test in SPSS with the model fit, regression coefficients estimate, and collinearity diagnostic statistics to explain the predictive relationship, if any between the three predictors collectively and the criterion variable. The model summary estimated the Adjusted R Square, which describes how much of the variation in the first-term GPA is attributed to the predictor variables concurrently (number of earned credits in general education, college readiness, and career and technical). The analysis of variance summary included the F-value associated with measuring the significance level of the model fit tested at significance level p-value$< .05$. The regression coefficients explained the relationship by summarizing the significance level and direction for the change in first-term GPA based a unit change in the predictors controlling for the others. The data analysis tested the hypotheses to determine if there is

a statistically significant relationship between the number of college credits earned by

dual enrollment students in three core disciplines concurrently and the first-term

community college GPA (criterion variable) to determine which core discipline credits

contributes to change in academic performance measured by first-term GPA.

I conducted three simple linear regression analyses to test the second, third, and

fourth null hypotheses to explain the extent of the relationship for each individual

predictor to understand each individual variable's effect in the criterion variable. Testing

each individual predictor (the number of credits earned in general education, career and

technical education, and community college orientation courses) estimated the strength of

each relationship and the extent of change in first-term GPA as a measure of college

readiness. Each simple linear regression analysis tested the individual hypotheses to

determine which earned college credits predicted the first-term GPA to measure college

readiness. I used the following prediction equation based on the assumed linear

relationship between the variables: $Y'= b_0 + bX$, where the b_0 is the unstandardized

coefficient beta constant (intercept) and the slope coefficient bX is the unstandardized

coefficient for the predictor multiplied by the number of credits for each individual core

discipline to predict "Y" ,which is the estimated prediction for the first-term GPA.

I explored each linear relationship using regression statistical test to analyze

model fit, regression coefficients, estimates, and 95% confidence interval for each

predictor and criterion variable. The model summary estimated the Pearson's r

correlation, which measured the linear correlation or strength and direction of the

relationship between the variables. An r- value of "0" estimated no linear relationship, a

value closer to "1" estimated a strong positive linear relationship, and a value of "-1"

estimated a strong negative relationship between the predictor and the criterion variable.

The Adjusted R^2 explained the amount of variation in the first-term GPA (criterion

variable) contributed by the individual core discipline (predictor variable). The analysis

of variance summarized the model fit and tested the significance level associated with the

F-value for the relationship between the variables in the model at $p < .05$. The regression

coefficients estimated the unstandardized coefficients to describe the intercept and the

slope used in the prediction equation to estimate the first-term GPA based on a unit

change in the predictors. The regression coefficients summarized the level of significance

for the estimated direction and the unit change in the criterion variable based on a unit

change in the predictor. A 95% confidence interval measured the estimated mean value

range for the first-term GPA based on the slope to predict first-term GPA (criterion

variable). The simple linear regression analysis further characterized the relationship

between the number of credits earned in each core discipline during dual enrollment and

the first-term GPA to determine which earned credits predicted college readiness.

The SPSS output provided evidence and support for the observed model fit, linear

relationship, and contribution to variation in the criterion variable due to unit changes in

the predictor variables.

Threats to Validity

There are threats to validity for the study related to generalizability, sampling

methods, and maturation effects. As part of the nonexperimental quantitative research

design, I performed regression analysis on archival data from a nonprobability

convenience sample. The sample was not manipulated and dependent on the availability. The study was nonexperimental and did not compare dual enrollment students to non-dual enrollment students, which may challenge internal validity to determine a causal relationship between dual enrollment program participants and college readiness. However, the study explained the variation in first-term GPA of former dual enrollment students based on observed change in the number of college credits earned in the program to determine a positive or negative association between variables.

With the majority of community colleges providing dual credits, this study focused on former dual enrollment students who participated in a Michigan community college dual enrollment program. Dual enrollment programs are offered by both 2-year community colleges and 4-year colleges and universities, but this study has limited generalizability to only 2-year community colleges in Michigan. Focusing the sample on former dual enrollment program students who enrolled in the Michigan community college to measure college readiness is aligned to the study problem and purpose to examine the relationship of the number of courses completed in dual enrollment and community college students' first-term GPA.

The study used a convenience sample that is dependent on the availability of unmanipulated archived transcript data for former dual enrollment students. Therefore, the sample included missing or incomplete data. To avoid this threat, the data were carefully screened and coded to ensure the sample meets the required inclusion and exclusion standards to reduce the effect of extraneous factors. The convenience sample focused on former dual enrollment students who completed a high school diploma and

enrolled in the community college with no previous enrollments at other colleges during 2017 to 2020. Screening for students who have no previous enrollments at other colleges will avoid inclusion of students who are not considered first-time or first-year college students. The sample selection criteria for former dual enrollment students who completed a high school diploma and excluding those who earned a GED or equivalent diploma reduced natural maturation effects on their first-term college GPA performance.

To reduce the threat of violations of linear regression assumptions to determine association between the predictor and criterion variables, the sample was carefully tested to verify linearity, homoscedasticity, normality, and multicollinearity. To avoid the threat to internal validity, highly correlated variables would be explained and removed to avoid a type I error in determining whether the predictor variables contribute a unique change in the criterion variable. The scope of this research focused on changes in the predictor variables— number of college credits earned in (a) general education, (b) career and technical education, and (c) community college orientation courses —and their impact on first-term GPA. I sought to explain variation and determine a predictive relationship based on positive or negative association with the criterion variable.

Ethical Procedures

A letter of cooperation was received from the community college prior to proposal approval and confirmed access to utilize available data for research purposes. As part of the research approval process, I completed the IRB application and received approval on July 29, 2021, to begin data collection to study the RQ outlined in the research methodology. Upon receiving IRB approval from Walden University, a formal

data request was submitted and approved according to institutional requirements and procedures to receive archival student records data and transcript information for research purposes.

To ensure student privacy and confidentiality, the formal data request did not request identifying information for students to safeguard students' identity and confidentiality for research purposes. As a result, student identification was hidden by assigning unique case numbers for each student to protect their identity while remaining in compliance with both institutional and IRB regulations for privacy. Although archival data sources reduced financial and recruitment burdens, there were constraints related to delayed processing time and availability of the requested data for analysis. Additionally, the unexpected effect on staffing constraints due to COVID-19 pandemic presented unplanned delays for data request processing by the college. The data were secured in a password-protected storage file to safeguard student privacy and anonymity for the institution. The data and findings were only used for research purposes outlined in this research study design.

Summary

Chapter 3 provided details on the research design, methodology, data analysis plan, and discussion of issues related to validity and ethical procedures. The study used an observational approach and causal-comparative design to explain the extent that college credits earned in dual enrollment contribute unit change in first-term GPA to predict and measure college readiness. A convenience sample of archival data from the partnering Michigan community college comprised of former dual enrollment student

transcript records of course-taking subjects, units, and first-term GPA in the first year of college. The sampling procedure was used to reduce challenges in recruitment and increase the potential sample size . A regression statistical analysis was conducted to examine the relationships of three predictors collectively and individually with one criterion variable. The statistical analysis summarized the model and determined which predictors contributed to unit change in first-term GPA to measure college readiness.

The data analysis plan clarifies the RQ and rationale for using both a multiple linear regression and simple linear regression statistical test, as well as how the data were collected for the study. Although generalizability is limited to dual enrollment programs offered by the partnering Michigan community college, the research design and variables are grounded by the theoretical framework and scope of the study. Chapter 4 provides a detailed discussion of the study results, data collection process to include discrepancies and modifications, descriptive statistics to clarify sample characteristics, and results of the statistical analyses and tests aligned with the RQ and associated hypotheses.

Chapter 4: Results

Introduction

The purpose of this study was to examine the relationship between the number of college credits earned in general education, career and technical education, and college orientation courses by former dual enrollment students in high school and their first-term GPAs upon enrollment at the partnering Michigan community college. I conducted a multiple linear regression and three simple linear regressions on archival transcript data collected from the partnering Michigan community college for former dual enrollment students in their first year of college. In this chapter, I first provide details of the data analysis plan and process used to collect and analyze the data. This discussion is followed by an analysis summary in which I present the results according to the RQ.

I conducted a multiple linear regression analysis to examine the overall model relationship between former dual enrollment students who earned dual enrollment credits in general education, career and technology education, and community college orientation courses (predictors) and their first-term GPA (criterion). The multiple linear regression summarized the model fit and how each predictor contributes change and estimate variation in the criterion variable. A simple linear regression for each individual predictor was used to examine the strength and direction of the relationship between credits earned in general education, career and technical education, and community college orientation courses during dual enrollment to predict their first-term GPA. The regression results were examined to determine the extent of how credits earned in each discipline predicts GPA to measure college readiness. The overarching RQ and respective

hypotheses informed the data analysis. The RQ was, To what extent does the number of

college credits earned during dual enrollment in general education, career and technical

education, and community college orientation courses predict GPA in the first year of

community college? The following hypotheses were tested to explain the association

between the predictor variables (the number of college credits earned by dual enrollment

students in (a) general education, (b) career and technical education, and (c) college

orientation courses) and the criterion variable (first-term GPA in community college):

$H_0$1: There is no statistically significant relationship between the number of

college credits earned in general education, the number of college credits earned

in career and technical education, the number of college credits earned in

community college orientation courses by dual enrollment participants, and first-

term college GPA in community college.

H_a1: There is a statistically significant relationship between the number of college

credits earned in general education, the number of college credits earned in career

and technical education, the number of college credits earned in community

college orientation courses by dual enrollment participants, and first-term college

GPA in community college.

$H_0$2: There is no statistically significant relationship between the number of

college credits earned in general education courses by dual enrollment

participants and first-term college GPA in community college.

H_a2: There is a statistically significant relationship between the number of college

credits earned in general education courses by dual enrollment participants and

first-term college GPA in community college.

H_03: There is no statistically significant relationship between the number of

college credits earned in career and technical education courses by dual

enrollment participants and first-term college GPA in community college.

H_a3: There is a statistically significant relationship between the number of college

credits earned in career and technical education courses by dual enrollment

participants and first-term college GPA in community college.

H_04: There is no statistically significant relationship between the number of

college credits earned in community college orientation courses by dual

enrollment participants and first-term college GPA in community college.

H_a4: There is a statistically significant relationship between the number of college

credits earned in community college orientation courses by dual enrollment

participants and first-term college GPA in community college.

Study findings are explained in detail according to RQ and associated hypotheses.

Descriptive statistics are discussed to characterize the sample; associated tables and

graphs are included as appropriate.

Data Collection

I used archival transcript data from a Michigan community college management

information system that maintains academic history for former dual enrollment students

who enrolled for the first time from 2017 to 2020. A written cooperation letter and data

request were submitted in July 2021 for approval to retrieve data and conduct research according to the college requirements. The written request was approved by the partnering college to utilize existing archival student transcript data for research purposes, while maintaining participant confidentiality. Before collecting data, I obtained approval from the Walden IRB. Permission was granted on July 29, 2021, to conduct the study. The IRB approval number granted for this study is 07-29-21-0087056. Following Walden IRB approval to conduct the study, a formal data request with specific data elements and variables was submitted to the Michigan community college for data collection.

Discussions with the information technology division of the institution provided clarity regarding the availability of data for each requested variable. The variables I requested were the total number of dual enrollment credits earned, the total number of credits earned in general education courses, career and technical education, community college orientation, and first-year GPA for students who attended the community college during 2017 and 2020 for the first time as a first-year student. The calculated first-year GPA for former dual enrollment students was not available. Therefore, the college provided the first-term GPA in their first enrolled year for former dual enrollment students. The adjustments to the requested data variables were made in the data analysis plan and discussed in Chapter 3 to address this modification.

College staff provided the requested archival student record information for students enrolled at the partnering Michigan community college from 2017 to 2020 in an Excel file stored in an external USB drive. To ensure security of each student's

institutional record, staff provided unique ID numbers with no student names. The data in

the Excel file included unique ID, first term of college enrollment as a first-year student,

number of credits earned in (a) general education, (b) career and technical education, (c)

community college orientation courses and first-term GPA. The predictor variable credits

earned in community college orientation is a bivariate variable and was coded with "0"

representing no earned credits and "1" for students who earned one or more community

college orientation credit. Missing values for incomplete cases were coded "999". I

cleaned the data file to remove blank cases in each of the variables. An example of a

missing or incomplete case included a record with no total earned college credits, no

credits earned in any of the variables, or no first-term GPA. After the data file was

cleaned for analysis, the Excel file was imported in SPSS for coding and analysis

Verification of assumptions, descriptive statistics, and frequencies were conducted for the

regression analysis conducted on the data file with details described further in the results.

The sample collected from the Michigan community college was representative of

the dual enrollment student population who subsequently enrolled in their first year of

college. The sample size collected was 524 cases, which exceeds the minimum sample

size of 77 calculated by the G*Power analysis referenced in Chapter 3. The sample

comprised of former dual enrollment students who enrolled in the community college for

the first time in at least one of the fall, spring, or summer semesters from 2017 to 2020

and earned at least one college credit in general education, career and technical

education, or community college orientation courses. Former dual enrollment students are

any students who completed a high school diploma and earned at least one college credit

while in high school as a junior or senior and did not earn any college credits from another college. Baseline descriptive statistics were comprised of 524 former dual enrollment students representing a mean total dual enrollment earned college credits of 16.86 and 2.62 first-term GPA. The sample included 46.9% students who earned community college orientation credits. Mean college credits earned in general education and career and technical education courses were 19.01 and 5.84, respectively. The sample characteristics were representative o first-year college students who earned any dual enrollment college credits at the partnering Michigan community college.

Results

I discuss data findings in relation to the study's overarching RQ and specific hypotheses. The Excel file data were imported into SPSS to verify assumptions for the statistical tests, calculate descriptive statistics for the sample, and conduct statistical tests to examine each hypothesis. I performed multiple linear regression to examine model fit for the collective predictors (dual enrollment credits earned in general education, career and technical education and community college orientation courses) and estimate unit change in the first-term GPA controlling for each predictor and the outcome variable (first-term GPA of former dual enrollment first-year students). Three individual simple linear regression statistical tests were conducted to further describe the strength and direction of the relationship between each pair of independent variables to predict the criterion variable. Multiple linear regression is used to measure overall model fit and summarize the relationship and contribution to variation concurrently between more than two predictors and the outcome variable, while controlling for the effects of each

predictor (Warner, 2013). Simple linear regression is performed to analyze quantitative or dichotomous variables to explain the extent of the association, strength and direction of the relationship, and extent of how the variables predict change in the outcome variable (Schroeder et al., 2017b). The data were tested to identify outliers and verify the statistical assumptions for the regression analyses to confirm appropriateness for each statistical test.

Verification of Assumptions

There were four assumptions tested to verify the appropriateness for each statistical test conducted to examine the RQ and respective hypotheses. The data were tested for normal distribution, linearity, homoscedasticity, and multicollinearity, which confirmed or identified any violations of assumptions for both multiple linear regression and simple linear regression analyses. Verifying each assumption for multiple linear regression and simple linear regression statistical tests determined if the data can be analyzed using each statistical test. The assumptions were verified using a histogram, normal P-P plots, scatterplots, and collinearity diagnostics to include the variance inflation factor (VIF) statistic.

Normality

First, I plotted a histogram of the first-term GPA (dependent variable) to test the normal distribution of the sample. A histogram was created to verify normality of the distribution of data for the quantitative outcome variable first-term GPA. Figure 1 presents a histogram of the first-term GPA demonstrating the distribution and shape of the values for the variable. It was determined the first-term GPA was not normally

distributed based on a normal bell shape curve of the data. To further investigate

normality, a boxplot analysis was conducted to identify any outliers. There were no

outliers observed in the boxplot. Normal distribution or normality for the first-term GPA

(criterion variable) was not observed in the histogram based on a left-skewed distribution

of the values with majority of the sample having a high first-term GPA. The left-skewed

distribution was analyzed with a skewness value of -.744, which is less than -1.0.

Skewness represented in a histogram is a measurement used to determine symmetry or

lack thereof in the distribution or shape of the data characterized in a histogram (Warner,

2013). Although the data sample did not satisfy the normality assumption determined by

a normal bell curve shape of the histogram, the large sample size inferred normality

described by the central limit theorem. Bootstrapping was not conducted on the data as

the sample was not the proposed 1,500 sample size due to data availability and low

enrollment effects from COVID-19 pandemic.

Figure 1

Histogram of First-Term Grade Point Average (GPA; Criterion Variable)
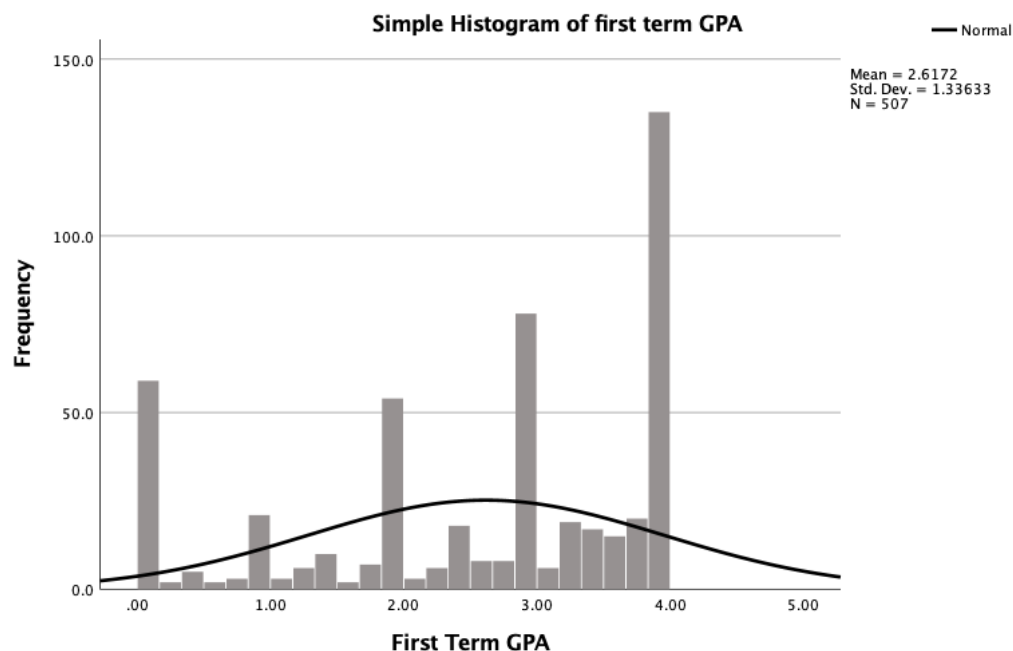
The central limit theorem suggests that the larger the size of the sample, normality is inferred due to the narrowing of the distribution of the data around the mean for the variable (Vogt, 2005). According to the central limit theorem, larger samples with skewed distribution may allow researchers to infer or predict relationships with confidence in social science statistics of commonly investigated variables (Lewis-Beck et al., 2004). Therefore, I determined that the sample met the normality assumption inferred by central limit theorem criteria, which describes allowable use of data that are not normally distributed in shape required for the regression analysis.

Linearity

The assumption linearity was tested to verify if there is a linear relationship between predictor variables and the outcome variable. I graphed a series of P-P plots to

verify a linear relationship between each pair of predictors and the outcome variable. The

community college orientation predictor variable is a dichotomous variable with "0"

indicating no community college orientation earned credits and "1" indicating at least on

earned credit in community college orientation courses and is determined linear. Figures

2, 3, and 4 present P-P plots demonstrating a linear relationship between the pairs of the

predictors and the outcome variable, first-term GPA.

Figure 2

P-P Plot of First-Term Grade Point Average (GPA) Regression Standardized Residual:
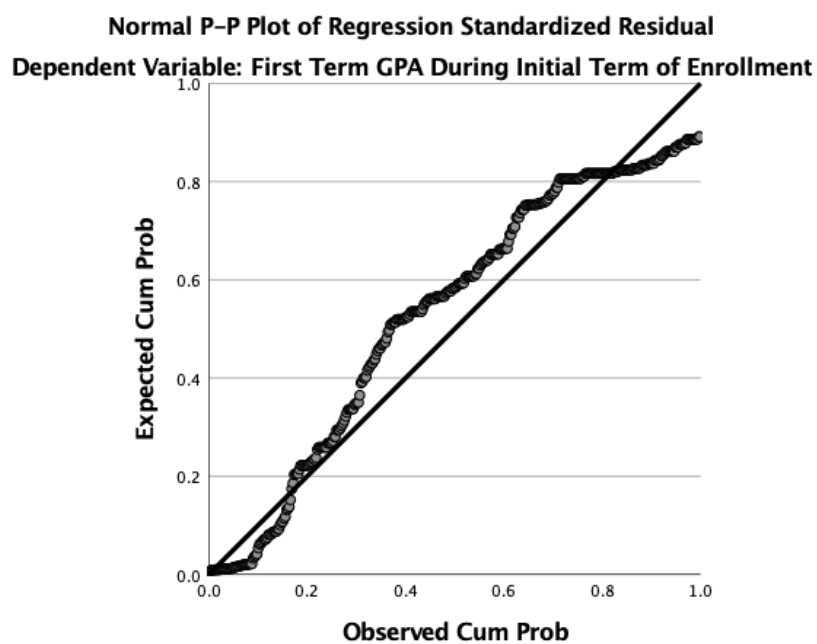*General Education Credits*

Figure 3

P-P Plot of First-Term Grade Point Average (GPA) Regression Standardized Residual: Community College Orientation Credits

Normal P–P Plot of Regression Standardized Residual
Dependent Variable: First Term GPA During Initial Term of Enrollment

Figure 4

P-P Plot of First-Term Grade Point Average (GPA) Regression Standardized Residual: Career and Technical Education Credits
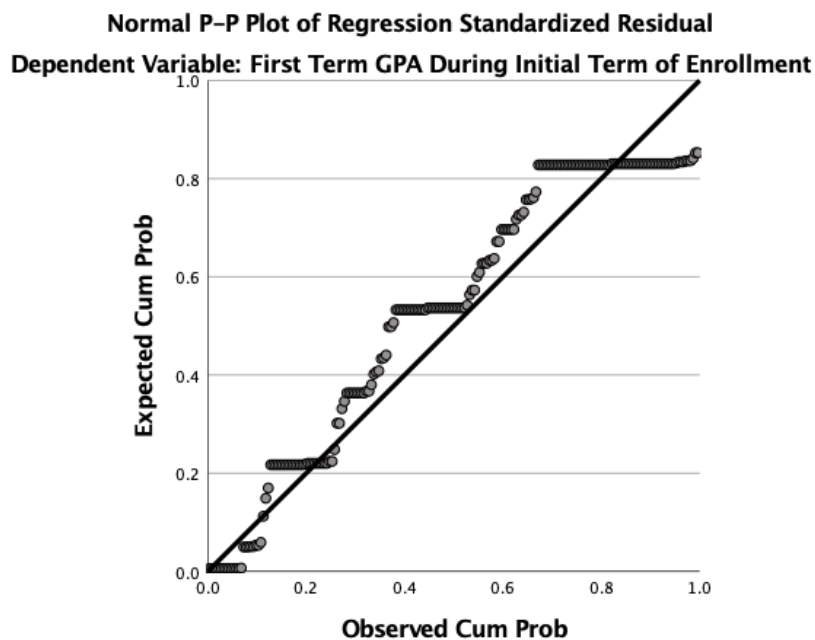
Homoscedasticity

Homoscedasticity of residuals verifies whether the variances at each level of the predictors (earned credits in general education, community college orientation, and career and technical education courses) and the criterion variable (first-term GPA) are consistent and equal (Warner, 2013). Scatterplots were graphed for each pair of predictors and the criterion variable to verify equal error variances that are randomly dispersed without clustering. Figures 5 and 6 present the random displacement of residuals confirming the data met the homoscedasticity assumption. However, the community college orientation earned credits predictor is a bivariate variable and displayed a pattern specific to coding of "0" for no community college orientation credits earned and "1" for at least one credit earned.

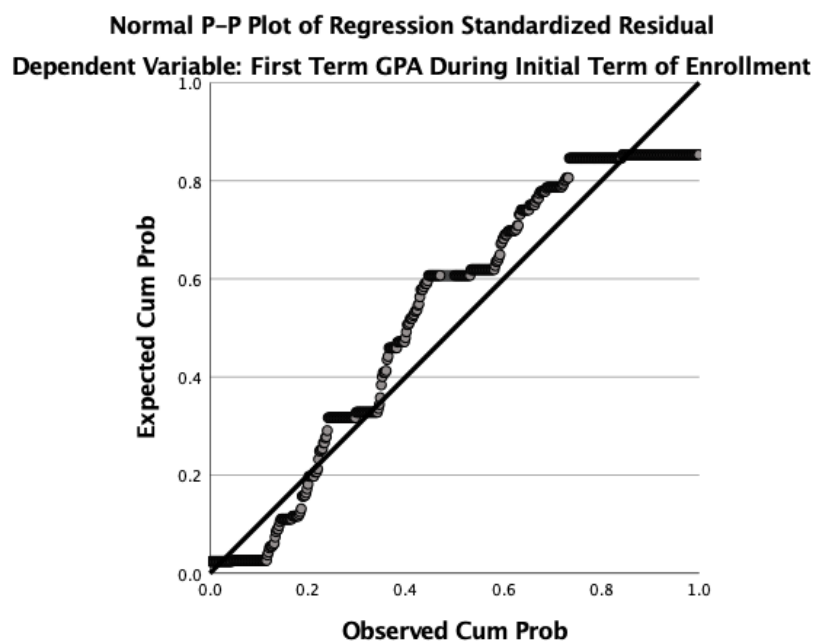**Figure 5**

P-P Plot of First-Term Grade Point Average (GPA) Regression Standardized Residual: Career and Technical Education Credits
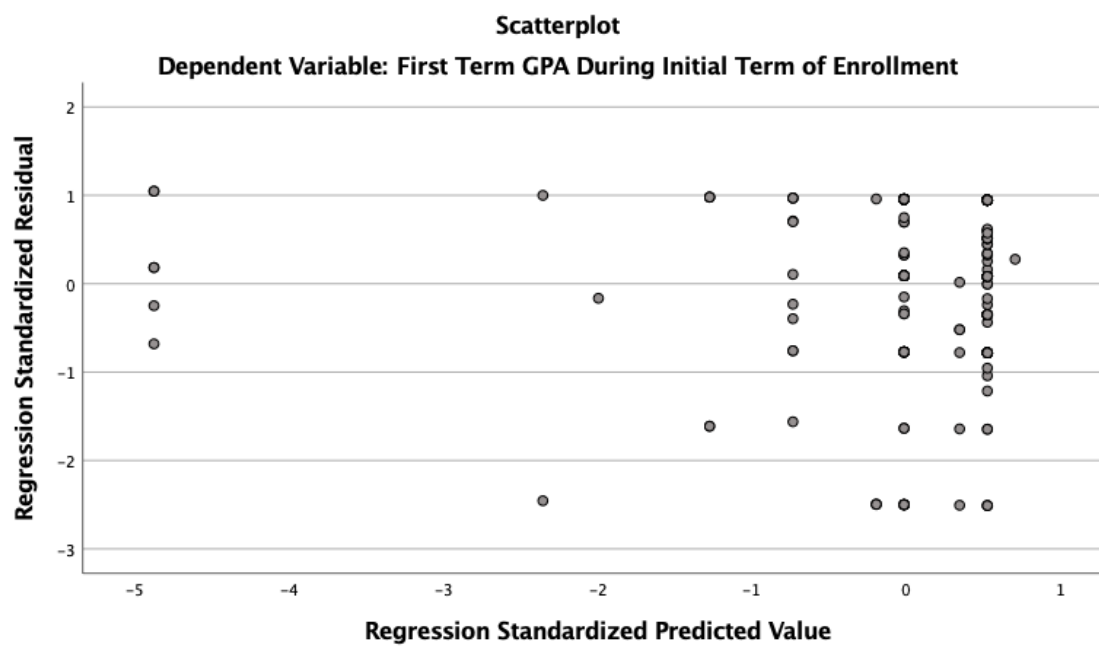
Figure 6

P-P Plot of First Term Grade Point Average (GPA) Regression Standardized Residual: General Education Earned Credits

Scatterplot
Dependent Variable: First term GPA During Initial Term of Enrollment
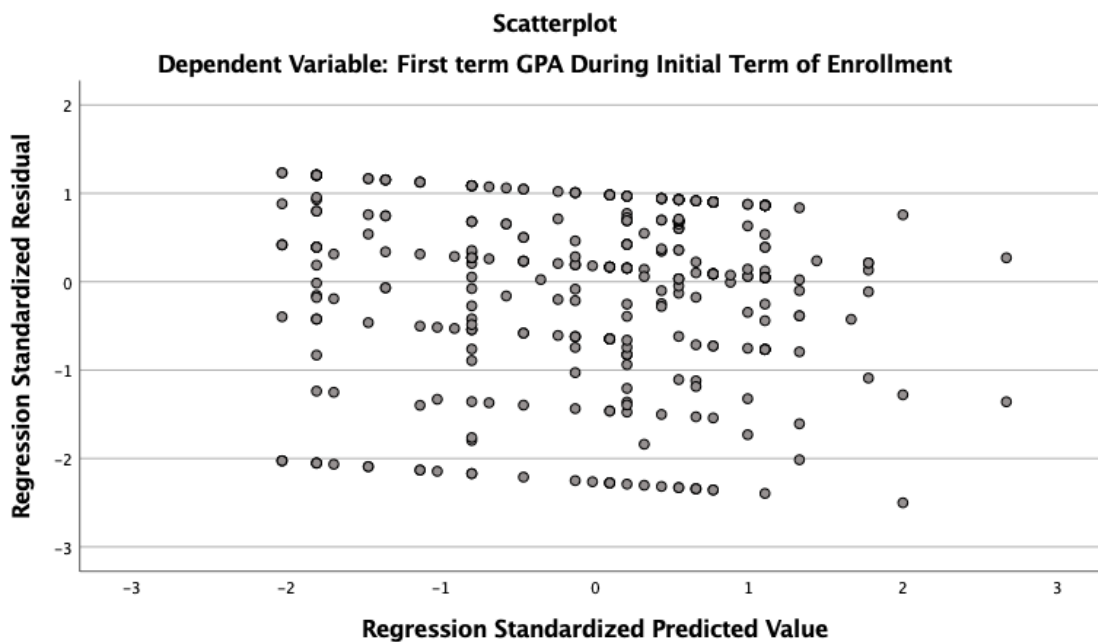
Multicollinearity

Multicollinearity determines whether there is significant correlation among the predictors limiting determination of how each individual variable contributes to predictive change in the outcome variable (Warner, 2013). Collinearity statistics to include the VIF were conducted to determine if there was significant correlation between each predictor. The VIF values for earned credits in community college orientation, career and technical education, and general education courses were 1.098, 1.006, and 1.101 respectively. The VIF values were all less than 10 verifying that the multicollinearity assumption was met to conduct the regression analysis.

Three of the four assumptions were verified with a violation of the linearity assumption. However, the central limit theorem infers linearity maybe assumed due to the

large sample size. The data met the linearity assumption and could be analyzed using multiple linear regression and simple linear regression statistical tests. Discretion is advised in the use of the results due to the study focusing on data specific to a Michigan community college and the absence of normality observed in the histogram for the first-term GPA. It is determined that the analysis would be conducted based on the verification of assumptions for the regression analysis.

Descriptive statistics were analyzed to summarize key characteristics of the sample. The descriptive statistics represent the mean credits earned in general education, career and technical education, total dual enrollment, and first-term GPA. Frequencies for community college orientation credits earned during dual enrollment was conducted with the mean first-term GPA for the bivariate variable. Tables 1 and 2 include details and characteristics of the sample.

Table 1

Descriptive Statistics: Earned Credits Mean

Variable	*N*	*M*	*SD*
Total earned dual enrollment credits	507	16.86	12.426
General education credits	383	19.01	8.956
Career and technical education credits	200	5.84	5.560
First-term grade point average	507	2.6172	1.336

Table 2

Descriptive Statistics: Earned Community College Orientation Credits

Variable	N	Valid %	First-term grade point average M
No. of community college orientation credits	278	53.1	2.6366
Community college orientation credits	246	46.9	2.5948

A regression analysis was conducted to investigate the relationship between credits earned in general education, career and technical education, and community college orientation credits simultaneously and individually to determine the extent that each discipline credits predict first-term GPA. The regression analysis included a multiple linear regression and series of simple linear regressions to evaluate the overarching RQ: To what extent does the number of college credits earned during dual enrollment in general education, career and technical education, and college orientation courses predict GPA in the first year of community college? Regression analysis examines the direction and strength of the relationship between individual and multiple predictors to predict the outcome variable changes with unit changes of the predictors (Frost, 2019). A multiple linear regression was conducted to determine if the model of earned credits in general education, career and technical education, and community college orientation courses during dual enrollment could significantly predict first-term GPA for first-year students of a Michigan community college.

The multiple linear regression statistical test was conducted to test $H_0 1$, which was, there is no statistically significant relationship between the number of college credits

earned in general education, the number of college credits earned in career and technical

education, the number of college credits earned in community college orientation courses

by dual enrollment participants, and first-term college GPA in community college. There

is no statistically significant relationship between the number of college credits earned in

general education, the number of college credits earned in career and technical education,

the number of college credits earned in college orientation courses by dual enrollment

participants and first-term college GPA in community college. Overall, the results of the

multiple linear regression model summary were not significant $F(3, 173) = 2.160$, $p =$

.095, $R^2 = .036$. The R^2 (.036) value indicated approximately 3.6% of the variance in the

first-term GPA is attributed to the three predictors in the model simultaneously. Table 3

presents the model summary statistics for the multiple linear regression. In the model,

there were no predictors that contributed significant variation in the first-term GPA at the

partnering Michigan community college. The model summary is not significant with a p

$= .095$ resulting in accepting the null hypothesis. Table 4 presents the regression

coefficients table that I used to determine the constant for the first-term GPA; as the table

shows, there were no predictors that resulted in a significant contribution to change in the

first-term GPA, while controlling for each predictor. The overall model to include credits

earned in general education, career and technical education, and community college

orientation courses did not contribute significant unit change or predict first-term GPA

for former dual enrollment students who attended the Michigan community college in

their first year. Therefore, I accepted the $H_0 1$ hypotheses.

Table 3

Multiple Linear Regression Model Summary

Model	R	R^2	SE
Model 1	.190	.036	1.14473

Note. Predictors were total college credits earned in general education, total college credits earned in career and technical courses, and credits earned in community college orientation. The dependent variable was first-term grade point average during the initial term in the Michigan community college.

Table 4

Multiple Linear Regression Coefficients

Model 1	Unstandardized coefficients		Standardized coefficients		
	B	SE	β	t	Sig.
1 (Constant)	2.799				
Community college orientation credits	.295	.184	.125	1.601	.111
Career and technical education credits	-.051	.033	-.115	-1.533	.127
General education credits	.009	.010	.068	.867	.387

Note. Predictors were total college credits earned in general education, total college credits earned in career and technical education, and credits earned in community college orientation. The dependent variable was first-term grade point average during the initial term in the Michigan community college.

A series of simple linear regression tests were conducted on each predictor individually to determine the strength and direction of the relationship to predict the criterion variable. The simple linear regression was used to describe the significance of a predictive relationship to determine how unit changes in each predictor may change the unit values of the outcome variable (Frost, 2019). The simple linear regression tested the following hypotheses:

$H_0$2: There is no statistically significant relationship between the number of college credits earned in general education courses by dual enrollment participants and first-term college GPA in community college.

$H_0$3: There is no statistically significant relationship between the number of college credits earned in career and technical education courses by dual enrollment participants and first-term college GPA in community college.

$H_0$4: There is no statistically significant relationship between the number of college credits earned in college orientation courses by dual enrollment participants and first-term college GPA in community college.

I conducted a series of simple linear regression to test $H_0$2, $H_0$3, and $H_0$4 to explain the relationship for each predictor to determine what extent discipline-specific credits predict first-term GPA. Table 5 summarizes the models and variation (R^2) for each

pair of predictors and first-term GPA. Table 6 presents the regression coefficients for

each model to determine which predictor contributes significant variation and to what

extent it predicts the first-term GPA. First, I conducted the regression for $H_0 2$, which tests

the relationship between earned general education credits and first-term GPA represented

in Model 4 of Table 5 and 6. As represented in Table 5 and Table 6, the overall model 4

for the number of credits earned in general education courses during dual enrollment and

first-term GPA was significant $F (1, 381) = 5.341, p = .021, R^2 = .014$. The R^2 (.014)

value indicated approximately 1.4% of the variation in the first-term GPA is attributed to

the number of earned credits in general education courses. The Pearson's r for the model

summary is .118 representing a weak positive relationship with first-term GPA.

Therefore, I rejected the second null hypothesis.

Secondly, I conducted a simple linear regression analysis for $H_0 3$, which tests the

relationship between the number of earned college credits in career and technical

education and first-term GPA. Table 6 summarizes the regression coefficients for Model

3, resulting in the overall model for the career and technical education courses and first-

term GPA was not significant $F (1, 198) = .070, p = .791, R^2 = .000$. The Pearson's r for

the model summary is -.019 representing a weak negative relationship between the

number of credits earned in career and technical education courses and the first-term

GPA for former dual enrollment students. Therefore, every earned credit in career and

technical education courses decreased first-term GPA by .004 units and cannot predict

first-term GPA for former dual enrollment students at the Michigan community college.

As a result, I accepted the third null hypothesis.

Last, I conducted a bivariate linear regression to test the H_04 relationship between earned credit in community college orientation courses during dual enrollment and the first-term GPA of first-year community college students. The overall model was not significant F (1, 505) = .123, p = .726, R^2 = .000. The Pearson's r for the model summary was -.016 representing a weak negative relationship between the number of credits earned in community college orientation courses and the first-term GPA for former dual enrollment students at the Michigan community college. Therefore, earned credits in community college orientation courses decreased first-term GPA by .042 units and is not a significant predictor of first-term GPA for former dual enrollment students at the Michigan community college. As a result, I accepted the fourth null hypothesis.

The multiple linear regression model summary results demonstrated in Table 4 indicate that the overall model to include credits earned in general education, career and technical education and community college orientation college courses simultaneously is not significant and does not predict first-term GPA for former dual enrollment students in the first year of college. The simple linear regression models for each predictor confirmed no significant relationship between credits earned in career and technical education and community college orientation. However, general education credits earned during dual enrollment had a significant relationship with first-term GPA. Therefore, for every general education credit earned by former dual enrollment students, the first-term GPA value will increase by .016 units. The first-term GPA can be predicted with 95% confidence that it will increase within the range of .002 to .030 units in the first year of enrollment with each earned general education during dual enrollment program. There

were negative relationships with earned credits in community college orientation and career and technical education college courses, while there was a weak positive relationship with credits earned in general education courses and first-term GPA. As a result, earned credits in general education can predict first-term GPA of former dual enrollment students who attend the Michigan community college in their first year.

Table 5

Simple Linear Regression Model Summaries

Model	R	R^2	SE
Model 2: Community College Credits	-.016	.000	1.33749
Model 3: Career and Technical Credits	-.019	.000	1.15766
Model 4: General Education Credits	.118	.014	1.22783

Note. The dependent variable was first-term grade point average during the initial term in the Michigan community college.

Table 6

Simple Linear Regression Coefficients

Model		Unstandardized coefficients		Standardized coefficients			95.0% CI for B	
		B	SE	β	t	Sig.	LL	UL
Model 2	(Constant)	2.637					2.477	2.796
	Community college orientation credits	-.042	.119	-.016	-.351	.726	-.276	.192
Model 3	(Constant)	2.916					2.680	3.152
	Career and technical education credits	-.004	.015	-.019	-.265	.791	-.033	.025
Model 4	(Constant)	2.470					2.179	2.761
	General education credits	.016	.007	.118	2.311	.021	.002	.030

Note. The dependent variable was first-term grade point average during the initial term in the Michigan community college.

Summary

In this chapter, details were provided for data collection processes, sample descriptive statistics, sample modification, statistical assumption verification, and results. The regression analysis included a multiple linear regression and a series of simple linear regression analyses. I performed these analyses to explain the relationship between each predictor individually and collectively and to determine to what extent earned credits predicted the outcome variable first-term GPA of former dual enrollment students who attended a Michigan community college. The study used a convenience sample of 524 former dual enrollment students who earned college credits at the Michigan community college and enrolled for the first time between 2017 to 2020. The mean credits earned by former dual enrollment students from the Michigan community college was 16.86 and the mean first-term GPA was 2.6172.

I based the analysis on the overarching RQ: To what extent does the number of college credits earned during dual enrollment in general education, career and technical education, and community college orientation courses predict GPA in the first year of community college? Verification of assumptions were tested to determine appropriateness for the regression analysis statistical tests for the study. Three of the four assumptions were met with no verification of normality due to skewness presented in the histogram of the first-term GPA (dependent variable). Although normality was not confirmed, the central limit theorem assumed the large size of the sample met the

statistical assumption requirement. Therefore, discretion should be used in the use of the data analysis results.

The overarching RQ and associated hypothesis were examined using regression analysis. The multiple linear regression analysis was conducted to determine if the overall model was significant in predicting first-term GPA for former dual enrollment students who enrolled in the Michigan community college in their first year. The results of the multiple linear regression were not significant $F(3, 173) = 2.160, p = .095, R^2 = .036$ resulting in the acceptance of the first null hypothesis. As a result, multiple linear regression analysis results determined that credits earned by former dual enrollment students in general education, career and technical education and community college orientation courses collectively did not contribute significant change or predict the first-term GPA.

A series of simple linear regressions were conducted for the number of credits earned in community college orientation, career and technical education, and general education courses to determine the characteristics, strength and direction of the relationship, and to what extent it predicts the first-term GPA individually. Of the three simple linear regression models, the number of credits earned in general education courses was the only significant model $F(1, 381) = 5.341, P = .021, R^2 = .014$ in predicting first-term GPA with a weak positive relationship with GPA. The simple linear regression models for credits earned in community college orientation and career and technical education courses were not significant and maintained a weak negative relationship with first-term GPA. Therefore, the second null hypotheses was rejected, the

third and fourth null hypotheses were accepted. Of the number credits earned by former

dual enrollments in the disciplines, the first-year students who earned general education

credits maintained a significant positive relationship with first-term GPA and is a

significant predictor for first-term GPA, as a measure of college readiness. In Chapter 5, I

interpret the findings, discuss the limitations of the study, offer recommendations for

further research, and consider the study's potential implications for positive social

change.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

Through dual enrollment programs, millions of U.S. high school students have taken college credits while in high school. The high number of students in these programs has caused concern for policymakers due to the many students who are not prepared for college (Campbell & Wescott, 2019; Chen, 2016; Taylor, 2015; Thomson, 2017). There was an increase of 30% in the number of students who participated in early college and dual enrollment programs in Michigan between 2015-16 and 2020-21 (MI School Data, n.d.). Community colleges are the largest contributor to the number of high school students earning college credits (Fink et al., 2017). As dual enrollment has grown, policy inconsistencies and lack of data collected at the national and state governing levels have hampered policy development, quality provisions, and assessment of overall effectiveness related to the programs (Pretlow & Patteson, 2015; Zinth & Taylor, 2019). Michigan was one of the states identified by the Higher Learning Commission (2013) as maintaining limited provisions and student outcomes data for dual enrollment programs. In this quantitative study, I analyzed archival data from former dual enrollment students who enrolled in their first year at the partnering Michigan community college to address the limited data collection on outcomes. The findings from the study may contribute to the literature on measures of college readiness.

The purpose of this quantitative study was to examine the relationship between the number of college credits earned in general education, career and technical, and community college orientation courses completed by former dual enrollment students in

high school and their first-term GPA upon enrollment at the partnering Michigan community college as a measure of college readiness. I used available data from a large dual enrollment program to ensure a representative sample. The sample consisted of 524 former dual enrollment students who attended the partnering Michigan community college as first-year college students during 2017 to 2020. A regression analysis featuring a multiple linear regression and a series of simple linear regressions was conducted to examine the overarching RQ, which was, To what extent does the number of college credits earned during dual enrollment in general education, career and technical education, and college readiness courses predict GPA in the first year of community college?

Overall, the multiple linear regression model was not significant with none of the predictors contributing significant change in the first-term GPA. The series of simple linear regression analysis characterized the strength and direction of the relationship resulting in weak relationships to predict first-term GPA, as a measure of college readiness. There were negative relationships between credits earned in career and technical education and community college orientation resulting in decreases of first-term GPA. However, credits earned in general education college courses had a significant weak positive relationship in predicting the first-term GPA of former dual enrollment students in their first year of college. The findings advance knowledge related to the number of course-taking units in discipline-specific college courses during dual enrollment and college readiness as measured by the first-term GPA. In this chapter, I

interpret key findings, discuss the study's limitations, offer recommendations for further research, and consider the study's social change implications for college readiness.

Interpretation of the Findings

I analyzed data from former dual enrollment students who attended the partnering Michigan community college as first-year college students during 2017 to 2020 to determine to what extent college credits earned in three disciplines predicts first-term GPA as a measure of college readiness. College readiness is defined as a student's academic preparedness for postsecondary education as measured by rigorous course completion, grade point average, and the lack of remediation in college (Malin et al., 2017). This study focused on two key academic dimensions of Conley's (2010a) college and career readiness model to include content knowledge and cognitive strategies that are fundamental to college readiness. The two interconnected dimensions focus on key measures related to course-taking patterns and number of credit units earned in best practice college courses as key determinants for college readiness. In Chapter 2, Conley's key dimensions of content knowledge and cognitive strategies were discussed in detail to outline fundamental measures of college readiness for the purposes of this research study. A multiple linear regression and a series of simple linear regressions were conducted to examine the RQ to determine which predictors contributed change in the first-term GPA to predict college readiness.

Findings from the multiple linear regression indicated the overall model was not significant between college credits earned in general education, career and technical education and community college orientation courses and the first-term GPA. Generally,

there were no predictors in the model that contributed significant change in the first-term GPA for former dual enrollment students in their first year of college. Both credits earned in community college orientation and career and technical education college courses contributed an insignificant negative unit change in first-term GPA for former dual enrollment students in their first year at the partnering Michigan community college.

I conducted a series of simple linear regression analyses to further understand the strength of the relationships and determine which discipline college credits predicted significant change in the first-term GPA for former dual enrollment students. For every credit unit earned in career and technical education and community college orientation courses, there was a decrease predicted for the former dual enrollment students' first-term GPA. Despite the nonsignificant contribution to change in first-term GPA by credits earned in general education courses in the multiple linear regression overall model, the simple linear regression results expanded the analysis with details of a significant weak positive relationship that predicted a unit increase in first-term GPA for first-year former dual enrollment students. Study findings suggest that every college credit unit earned in general education courses by former dual enrollment students may result in an increase in their first-term GPA (as a measure of college readiness) by .016 units.

This quantitative study offers empirical data related to course-taking credits earned in best practice disciplines during dual enrollment to determine what extent each the credits predict GPA in their first year. This study differs from current research by analyzing incremental data during dual enrollment and examining how earned college credits in specific disciplines are more likely to predict college readiness evidenced by

academic performance (first-term GPA) in their first year. Generally, dual enrollment programs research report overall positive outcomes upon college-entry and degree completion (Cowan & Goldhaber, 2015; Morgan et al., 2018). This study broadens knowledge by examining how course-taking units in best practice subjects predict college readiness using first-term GPA. Although there is limited data collection for academic performance and course-taking patterns in dual enrollment, the results confirmed, extended and disconfirmed knowledge regarding dual enrollment student outcomes. Study findings are discussed further to explain how the results advances knowledge related to dual enrollment program's role in college readiness.

Community College Orientation Credit

Dual enrollment programs provide high school students with early access to college going skill development and rigorous content in best practice courses to prepare them for college. The partnering Michigan community college provided dual enrollment students with a college orientation course that promote skill development for college going behaviors, study habits, thinking skills, and college behaviors to help them navigate college norms for success. The college orientation course provides skill development related to both cognitive strategies, academic behaviors, and college norms or understanding of systems to help them cope in college. Conley's key dimensions of college and career readiness model suggests that key content knowledge and cognitive strategies are interconnected with academic behaviors and contextual skills and awareness which are are important to gain self-management and college knowledge skills (Conley, 2010a). The study findings examine the relationship between the community

college orientation course that focus on academic behaviors and contextual skills and how this course prepares dual enrollment students for success in their first term of college.

Available data and research focus on qualitative experiences of students to determine how early college programs prepare students for college. Although there is limited academic performance data to measure dual enrollment students' cognitive skill development and college readiness, research suggested students perceived positive college-going skill development through dual enrollment participation (Kanny, 2015; Lile et al., 2018). As part of an early college program evaluation of an entry-level math course in fall 2013, there was a 64% increase in student perceived college readiness due to their experiences in a dual enrollment program (Cevallos et al., 2016). Dual enrollment students reported advantages such as early exposure to rigorous academic content, understanding hidden curriculum elements from interacting with college faculty, and perceived academic freedom and independence from high school structured context (Kanny, 2015). This study examined academic performance for dual enrollment students to expand data for college readiness according to academic behaviors and contextual college-going skills developed in college orientation courses.

The study analyzed the relationship between credits earned in the community college orientation course and first-term GPA to determine if credits earned in the course predicted college readiness. There was no significant contribution to the unit change in first-term GPA for former dual enrollment students who earned community college orientation course credits at the partnering community college. The mean first-term GPA

for former dual enrollment students who earned the community college orientation credit was 2.59 and those who did not was 2.64. There was a weak negative relationship for credit earned in community college orientation course and first-term GPA, which suggested that every student who earned the college orientation credit may have a decrease in their GPA of -.042. The results advanced knowledge unique to the partnering Michigan community college suggesting that earned credit in the community college orientation courses did not contribute a strong positive relationship or predict first-term GPA. The findings disconfirmed knowledge that college orientation courses at the partnering community college supported positive academic performance in their first year of college.

The community college orientation course offered by the partnering Michigan community college is provided as a college-entry course for dual enrollment to create a pathway to college. The college course is unique to this institution and serves as the introductory course to foster college-going behaviors, study skills, and college expectations. The community college orientation course is not a required course towards the associate's degree and is considered a college readiness course to prepare dual enrollment students for college-entry. Students are strongly encouraged to complete the course prior to college-entry courses offered in dual enrollment, but the credit does not fulfill program or degree requirements. Therefore, dual enrollment students may not successfully complete the course, which could impact successful course completion resulting in potential decline in GPA.

Career and Technical Education Credit

Dual enrollment programs are primarily offered by community colleges to increase access to college and career pathways to degree completion in occupational programs. Community colleges are uniquely positioned to integrate career and technical education courses in dual enrollment to advance career pathways and college readiness (Haag, 2015; Jones, 2014). Integration of career and technical with core academic knowledge during dual enrollment programs promote course rigor and relevance for the curriculum to prepare students for college and careers (Fletcher et al., 2018). College credits earned in career and technical education during dual enrollment should allow students to explore career pathways and prepare students for success in both college and workforce (Adcock et al., 2016; Fletcher et al., 2018). Conley's key dimensions of college and career readiness model suggests that high school students must gain academic knowledge and relevant occupation skills in real-world occupations to promote success in both the workforce and college (Conley, 2010a).

Dual enrollment programs offer career and technical education to promote career pathways and college readiness through rigorous course work and relevant training. Career and technical education courses provided in dual enrollment are limited to first-level introductory courses due to challenges in course location, licensure and certification age limits, and work-based learning requirements (Haag, 2015). Research findings from students spanning from 2008 to 2014 report higher graduation rates compared to their counterparts who did not participate in career and technical education (Morgan et al., 2018). However, the number of career and technical education courses completed in dual

enrollment were not key contributors to college graduation outcomes (Morgan et al., 2018). There is limited examination of career and technical education course credits earned in dual enrollment to determine differences in outcomes compared to non-career and technical education courses (Phelps & Chan, 2017). Phelps and Chan (2017) studied completion rates during 2008 to 2010 for students who earned dual enrollment credits in health, STEM (non-manufacturing), and information technology-related career programs and found higher completion rates compared to those who did not take career courses. This study findings revealed an insignificant, weak negative relationship with the first-term GPA for credits earned in career courses by dual enrollment students resulting in a decline in the first-term GPA. Therefore, this study expands knowledge for intermediate outcomes related to career and technical education course completion during dual enrollment and academic performance in the first year of college.

General Education Credit

Conley (2010) suggested a fundamental measure of college and career readiness focuses on academic performance in college-entry courses or equivalent coursework. The key content knowledge dimension of the college and career readiness model focuses on the academic preparation in best practice core subject areas in college-entry mathematics, English, science, humanities, and social sciences that are required for degree and certificate completion in the first year of college (Conley, 2010a). Completing college-entry courses in dual enrollment and early college programs develop key cognitive strategies as well as prepare students to advance their studies in their major of choice (Conley, 2010a). Following examination of college readiness high school assessment

benchmarks from graduates in 2009, it was found that students who completed general education courses maintained a higher GPA in their first year of college (Fina et al., 2018). Dual enrollment students who completed rigorous AP or dual enrollment college-entry math and English in high school were more likely to have higher college GPAs, retention, and less likely to require remedial courses in college (Bowers & Foley, 2018; Grubb et al., 2017; Hanson et al., 2015). Completion of core general education subjects advance college readiness in the first year and subsequent postsecondary outcomes.

This study examined college credits earned best practice general education by dual enrollment students while in high school to determine the extent it prepares them for college. The college catalog defines general education courses to include English, humanities, social sciences, humanities, math, and political science. Former dual enrollment students from this study earned 19.01 mean number of credits in general education, which is higher than the mean credits earned in college orientation and career and technical education courses. For every credit unit earned in general education courses by dual enrollment students, the first-term GPA may increase by .016. The analysis of credits earned in general education during dual enrollment and its relationship to first-term GPA confirms research that college credits earned in college-entry best practice general education courses increased college readiness.

This study confirmed and expanded knowledge and data related to early college credits earned during dual enrollment and its relationship to intermediate college readiness outcomes. Conley's key dimensions of college and career readiness model suggests that students who earn college-entry credits in general education are more likely

to have positive academic performance in their first year of college due to the broad transferable skills such as writing, mathematics, critical thinking, and science methodology that are required for both career and technical education and liberal arts courses (Fletcher et al., 2018; Wells, 2016). The study was grounded in Conley's theoretical framework by examining academic key dimensions and using GPA as a measure for academic performance and college readiness. Unlike the career and technical education and college orientation course findings, the study results predicted a positive change in the first-term GPA for the former dual enrollment students who earned general education credits, which may imply that students were more likely to successfully complete the course and earn credits towards the completion of degree requirements.

Due to limited data and variation in governing state policy requirements for student outcomes, there is little evidence and research on dual enrollment program course-taking patterns and academic performance in the first year of college. However, this study advances knowledge related to discipline-specific credit-completion patterns earned during dual enrollment to inform development of relevant college readiness metrics. The study revealed the potential advantage in using dual enrollment student outcomes to assess the effectiveness of early college courses in preparing students in high school for college-entry and subsequent success in their first year of college.

In addition to confirming the relationship of early general education college course completion and success, there were findings that dual enrollment students earned career and college orientation credits had lower academic performance in the first year of college. This study resulted in contrary findings related to earned college credit units in

career and technology education and college orientation courses during dual enrollment resulted in a weak negative relationship with first-term GPA and did not significantly predict college readiness. Alternatively, the study confirmed knowledge related to how earned credits in general education courses in dual enrollment promotes higher academic performance and college readiness using the fundamental measure of GPA in their first year of college. The study may expand research related to inconsistent college readiness metrics and data that may aid policy and dual enrollment program improvement; and postsecondary and secondary curriculum alignment to advance college readiness in Michigan.

Limitations of the Study

This quantitative study utilized a convenience sample of archival data from a Michigan community college which may have availability limitations. There were limitations due to data availability and unforeseen impact from the COVID-19 pandemic. There were data modifications unavailability for the first-year college GPA and the timeframe for enrollment after high school graduation. Although there were modifications to the variables, the study sample of 524 exceeded the required minimum sample size of 77 calculated by the G*power analysis. At the time of the study, there were data collection constraints due to COVID-19 pandemic challenges that imposed enrollment declines and staffing availability to export the data sample. The sample was collected from the community college information management system and included former dual enrollment students who enrolled for the first time during the fall, spring, and summer semesters during 2017 to 2020 at the Michigan community college. As a result,

the sample is representative of its neighboring school districts that partner with the college within its service region.

The study focused on a partnering Michigan community college which limits generalizability to 4-year universities and dual enrollment programs from different governing states. Each state maintains varying governing policies and reporting requirements hindering consistent data and information collection for dual enrollment programs. The partnering community college in Michigan is located where there are limited provisions related to data collection on student outcomes for dual enrollment programs reported to governing bodies. Therefore, there are limitations in generalizability to dual enrollment programs offered by different states with varying policy and reporting requirements or robust data collection systems to enforce compliance and quality assurance. Additionally, there is limited generalizability for dual enrollment programs offered by 4-year universities.

During verification of assumptions to determine if the data collected met the standards for the statistical test, there was a violation in normality identified in the histogram for the dependent variable. The analysis was conducted based on assumptions outlined in the central limit theorem. According to the central limit theorem, larger samples with skewed distribution may allow researchers to infer or predict relationships with confidence in social science statistics of commonly investigated variables (Lewis-Beck et al., 2004). The sample size exceeded the calculated sample size to conduct regression analysis and met the criteria outlined in the central limit theorem. Discretion is

advised in the use of the research due to limitations in generalizability and violation of normality for the first-term GPA.

Recommendations

The purpose of this study examined the relationship between the number of college credits earned in general education, career and technical, and community college orientation courses completed by former dual enrollment students in high school and their first-term GPA upon enrollment at the partnering Michigan community college. The study confirmed and advanced research related to using the fundamental measure of GPA to understand how course-taking and credits earned in best practice disciplines during dual enrollment relate to academic preparedness and college readiness (Conley, 2010a). Study findings suggested there were negative relationships between community college orientation and career and technical credits that do not significantly predict college readiness resulting in a decrease of the first-term GPA for former dual enrollment students in their first year of college. Additionally, credits earned in general education maintained a positive relationship that significantly predicted a unit increase in the first-term GPA, as a measure of college readiness. Therefore, credits earned in general education during dual enrollment is a significant predictor of college readiness measured by first-term GPA. The study confirmed research explaining how credits earned in college-entry general education courses such as mathematics, language arts, English, and science during dual enrollment may aid in preparing students academically in their first year as evidenced by a predicted increase in the GPA.

The scope and purpose of the study focused on the total number of credits earned in community college orientation, career and technical education, and general education courses offered by the partnering community college. As a result, the predictor variables in the study represent a culmination of several college credits earned in a variety of courses within each discipline by former dual enrollment students and the first-term GPA. Given the findings of the study resulting in both weak positive and negative relationships by each discipline to predict college readiness, it is recommended that further research is required to understand which specific college course credits within each discipline such as computer information systems, business, English, mathematics, biology and other offerings contribute to higher first-term GPA to predict college readiness.

The partnering Michigan community college is among other dual enrollment programs offered by local community colleges to promote educational attainment and college readiness. Each Michigan community college providing dual enrollment programs may not offer community college orientation courses limiting generalizability to all Michigan community colleges. For the purposes of this study, the dual enrollment program offered the community college orientation course to promote college-entry credit momentum and seamless college enrollment. Given the results of the community college orientation course not providing significant contribution to the overall model and decreasing the first-term GPA for former dual enrollment students in the first year, it is recommended that the community college orientation course be further evaluated to assess content, relevancy, and effectiveness in meeting college readiness goals.

Additional research is suggested for other dual enrollment programs that offer freshman

college readiness courses to revise the college orientation course goals and outcomes.

Collaboration with the high school to address college readiness curriculum may better

address the needs of the high school and provide meaningful college-entry experiences.

Generally, it is suggested the findings from this study can be used to improve

collaboration with high schools to develop an early college catalog of college-entry

course offerings that fulfill the first-year general education requirements for associate-

level degrees in both general studies and career and technical education programs.

Dual enrollment program outcomes are limited in scope, but have positive impact

on college-entry and long-term college success goals. Comprehensive outcomes for

college readiness require more robust data collection provisions, systems and clear

metrics (Zinth & Taylor, 2019). According to findings in previous literature for dual

enrollment and college readiness, the overall program maintains a positive effect on

GPA, graduation, retention, and college-entry without remediation (An, 2015; Bowers &

Foley, 2018; Edmunds et al., 2020; Taylor & Yan, 2018; Wang et al., 2015). Research

suggested an overall positive impact on college-going and performance due to dual

enrollment despite access to inconsistent or limited data information for college readiness

to inform policy and program improvement (An & Taylor, 2019; Grubb et al., 2017;

Morgan et al., 2018). Additionally, educators and policymakers suggested the need for

robust data collection systems for dual enrollment to address curriculum alignment

between secondary and postsecondary education and comprehensive analysis of student

outcomes and college readiness (Zinth & Taylor, 2019). This study examined college

readiness through exploration of early college credits earned in best practice college-entry courses during dual enrollment to advance student outcome metrics and intentional selection of courses offered during dual enrollment. While this study focused on an individual partnering Michigan community college, it is recommended that the findings are discussed broadly with other community colleges and statewide organizations to develop measures and success indicators to refine dual enrollment programs curriculum and evaluation.

The majority of community colleges in the State of Michigan use the institution information management system to gather data on student transcript information, demographics, graduation rates, and course-taking patterns. The data are archived and used for external compliance reporting to state and federal government entities. The MI School Data is a third-party agency contracted by the State of Michigan that gathers data and information for dual enrollment programs related to college enrollment, credits earned, and graduation to publicly share educational statistics with the community. Nevertheless, there is limited student-level data collected by state agencies to monitor dual enrollment program effectiveness and student outcomes. As dual enrollment programs continue to grow and expand college course offerings, it is suggested that state-level collaborative committees comprised of both secondary, community college educators and policymakers broaden the discussion to enforce data collection and reporting for college readiness and student outcomes.

The Higher Learning Commission accrediting body suggested a need for more robust data collection on student outcomes to inform dual enrollment effectiveness and

quality assurance (Higher Learning Commission, 2013). Given the current literature discussion of the importance of data collection to inform college readiness and policy development, it is suggested that state-wide governing committees and community colleges adjust and revise annual reporting requirements to establish a robust system for state-wide data collection of required college readiness indicators and outcomes for dual enrollment program compliance. It is suggested that the Michigan Department of Education authorize the third-party MI School Data organization to enforce reporting requirements beyond enrollment, graduation, and credits earned to develop meaningful metrics for dual enrollment program improvement and student success outcomes. Additionally, it is recommended that community colleges integrate dual enrollment programs and college readiness metrics into institutional priorities for regional or specialized accreditation.

Implications

Higher education has involved and transformed to meet the demands for careers and the workforce overall. As education in the United States continues to evolve, college readiness must transform to meet the societal, education attainment, and workforce demands that require a postsecondary credentials to close the skills gap in the workforce (Fletcher et al., 2018). More recently, higher education has experienced an enrollment crisis from COVID-19 that challenges colleges to adapt and disrupt its current models for programming and college readiness. Community colleges have experienced the greatest decline of -5.4% in its enrollment from Fall 2020 to Fall 2022 due to the pandemic (National Student Clearinghouse Research Center, 2022). Community colleges continue

to rely on its partnerships with secondary schools to provide dual enrollment programs that serve as a pipeline for college enrollment. Therefore, timely development and collection of structured data and student outcome metrics are critical for dual enrollment model expansion to expedite college enrollment and readiness benefits.

The study is grounded in Conley's college and career readiness theoretical framework that focuses on both academic and college-going knowledge for success and emphasizes the importance of early college programs. The model reinforces the importance of secondary and postsecondary alignment to intentionally develop curriculum that fosters completion of college-entry coursework to expand enrollment in college without need for remediation (Conley, 2010a; Karp, 2015; Thomson, 2017; Tierney & Duncheon, 2015). This study affirms the need for educators at both the secondary and postsecondary level to use college readiness data related to rigorous college course content and curriculum to improve dual enrollment programs goals for completion of transferable college credits that meet program degree requirements. College and high school administrators can potentially use relevant data to make informed decisions related to dual enrollment curriculum development and partnership alignment required for a seamless transition to college without remediation.

The State of Michigan utilizes a third-party agency to collect data related to earned college credits in high school, bachelor's degree attainment, and college types that offer dual enrollment to inform the community on dual enrollment program outlook. Although there is data collection in these important areas, they are focused on funding-related outcomes, rather than periodic or gradual student outcomes to inform dual

enrollment program improvement and planning. Zinth and Taylor (2019) reviewed state governing policies and discovered variation and inconsistencies in state policies related to data collection and compliance reporting, which reduce collection and use of reliable data and information to inform dual enrollment program effectiveness and policy development. Educators and policymakers require essential data and information to inform decision-making and advance education reform initiatives in response to changing environments to advance education attainment and overall positive social change. This study aids in researching incremental measures of college readiness to close the gap for consistent collection of robust and relevant student outcomes data. Additionally, the study contributes knowledge related to quality measures and data points to evaluate dual enrollment program effectiveness and student outcomes. This study findings may advance use of reliable and timely information by governing policymakers; develop and refine accreditation standards for dual enrollment; and enforce essential compliance requirements to monitor program effectiveness.

Accrediting bodies are required to evaluate community colleges to ensure quality provisions and standards are met in providing effective programs, support services, and relevant degrees and credentials. With community colleges maintaining the largest share of high school students participating in dual enrollment, accrediting bodies may examine quality measures and standards to improve quality measures for early college experiences to achieve college readiness. It is recommended for the regional accrediting bodies for institutions of higher education expand its research and establish criteria to monitor the effectiveness and student outcomes specifically for early college and dual enrollment

programs provided by Michigan community colleges (Taylor et al., 2015). Clarifying standards for college readiness programs in routine quality assurance reviews by accrediting agencies may enforce provisions for student outcomes that improve dual enrollment program effectiveness in preparing students for college.

Curriculum alignment between secondary and postsecondary advance college readiness and benefits for high school students to gain academic momentum towards completion of degrees. From the dual enrollment student perspective, dual enrollment programs helped them develop academically and behaviorally (Kanny, 2015; Lile et al., 2018). However, students and counselors suggested that earned college credits did not always transfer towards their degree requirements in their first year (Pretlow & Patteson, 2015; Witkowsky & Clayton, 2020). Dual enrollment programs promote academic momentum may assist college-entry credit attainment while in high school in an effort to reduce time to degree completion and tuition costs (Clovis & Chang, 2021; Tobolowsky & Allen, 2016a; Wang et al., 2015). However, the misalignment of the curriculum to meet degree requirements impedes seamless transferability of completed early college credits towards their degree of intent. This study confirmed completion of general education courses are more likely to predict college readiness measured by increasing the first-term GPA in the first year. As a result, students who complete general education courses are more prepared and likely to have better academic performance in their first year. It is recommended that third-party agencies like MI School Data agency expand the discussion related to eligible college course completion data to improve transferability of credits and return on investment for dual enrollment programs.

Conclusion

The purpose of this study was to examine college credits earned during dual enrollment in three best practice disciplines and its relationship to the first-term GPA as a measure of college readiness. Dual enrollment programs are offered to provide students with both rigorous college-entry courses and college-going experience to prepare for college without remediation (Conley, 2010a). Community colleges are uniquely positioned to provide dual enrollment programs that provide early college experiences in career and technical education and general education and are responsible for the largest share of students who earn college credits while in high school (Fink et al., 2017; Jones, 2017). Dual enrollment programs benefit both high schools and colleges by increasing college enrollment, educational attainment, and college and career readiness (Grubb et al., 2017; Morgan et al., 2018; Phelps & Chan, 2017). However, student outcomes data and information are inconsistent in evaluating dual enrollment programs' role in college readiness due to limited provisions for data collection for each state (Thomson, 2017; Zinth & Taylor, 2019). This study confirmed the importance of gaining a comprehensive understanding of how the type of college credits earned during dual enrollment predict a college readiness and subsequent academic performance in college.

The expansion of dual enrollment garnered the attention of educators to address curriculum alignment between secondary and postsecondary. Previous studies and knowledge suggested a need to ensure secondary and postsecondary curriculum alignment and structured policy development to promote college and career readiness (An, 2015; Phelps & Chan, 2017; Tobolowsky & Allen, 2016a). A shared and clear

understanding between secondary and postsecondary increases alignment and integration of academic and career and technical skills in the curriculum to promote positive college outcomes and reduce barriers to college readiness (Fletcher et al., 2018; Friedmann et al., 2016). As governing states pursue expansion of dual enrollment, research suggested that student progress and outcomes be routinely evaluated to ensure the program achieves the goal of college readiness (ACT, 2015). Due to varying policy environments in each state to monitor dual enrollment programs, it is suggested that policies evolve to meet the growing capacity and need for a shared understanding by all stakeholders related to advancing access, academic rigor, college readiness factors, and student outcomes (Pretlow & Patteson, 2015). This study contributes knowledge to support development of college readiness metrics related to early college course-taking patterns in core subject areas during dual enrollment programs to monitor program effectiveness and evaluate academic performance in the first year of college.

Dual enrollment programs provide an overall positive impact on student preparedness and exposure to academic and behavior skills required for college-entry. Despite positive outcomes related to college enrollment, retention, and college degree completion, there are inconsistent data collection structures across each state to collect program-specific student outcomes to evaluate dual enrollment program effectiveness (Taylor et al., 2015). Quality assurance provisions are institution-led and voluntary, which may hinder alignment to state-wide college readiness goals, college planning, reform initiatives, and accrediting standards. The NACEP accreditation agency identify standards to ensure quality programs that promote college readiness (Higher Learning

Commission, 2013; Scheffel et al., 2015; Taylor et al., 2015). Yet, these agencies are voluntary and not authorized to mandate consistent and reliable data collection for dual enrollment programs. Institutionalizing federal and state policies, robust data collection systems, and structured definitions to measure college readiness are important factors for understanding how higher education reform initiatives such as dual enrollment prepare students for college (Pretlow & Wathington, 2014; Zinth & Taylor, 2019). This study may contribute knowledge related to curriculum requirements to define and inform college readiness metrics and data collection practices that support planning, quality assurance, and higher education reform initiatives.

Early college initiatives such as dual enrollment streamline long-term college enrollment and degree outcomes. College readiness reform initiatives are imperative in addressing the educational attainment gap to meet the demands for credentials required for future careers in the workforce. In order to improve early college program success, clear metrics and definitions for college and career readiness must evolve to keep pace with the growth of college credits earned in high school. Refining and adopting comprehensive college readiness metrics focused on incremental and long-term change will best serve timely improvements in state policy, data collection, governance, planning, and institutional effectiveness. College readiness remains important for early college program growth, college enrollment, educational attainment, and return on investment in college degrees.

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Appendix A: Summary of G*Power 3.1 Analysis

G*Power 3.1

Central and noncentral distributions   Protocol of power analyses

critical F = 2.7318

Test family   **Statistical test**

F tests   Linear multiple regression: Fixed model, R² increase

Type of power analysis

A priori: Compute required sample size - given α, power, and effect size

Input parameters

Determine	Effect size f²	0.15
	α err prob	0.05
	Power (1-β err prob)	0.8
	Number of tested predictors	3
	Total number of predictors	4

Output parameters

Noncentrality parameter λ	11.5500000
Critical F	2.7318070
Numerator df	3
Denominator df	72
Total sample size	77
Actual power	0.8014400