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How Do Student and Secondary School Characteristics Explain College English I Completion in a Rural Arkansas Community College?

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How Do Student and Secondary School Characteristics Explain College English I Completion in a Rural Arkansas Community College?

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Doctor of Education in Adult and Lifelong Learning

by

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Abstract

Community colleges serve diverse populations that may not be as academically prepared as at four-year institutions. Accountability of higher education institutions is ever-increasing in importance, so understanding the contributing factors to student success is critical. Students bring a unique set of characteristics to the community college, including individual traits and secondary school experiences. Many studies have examined these characteristics at large urban or mid-western institutions, but few in rural settings. Rural areas of the United States have lower rates of educational attainment than other areas, which often translates to lower incomes. It is the mission of community colleges to train the future workforce which should result in a highly skilled workforce with wages to make a comfortable living.

To graduate from any higher education institution in Arkansas, students must complete college-level gateway courses. These courses are the first indicators of success. There are many established predictors of college success. These factors could fall in any level of Bronfenbrenner's Theory of Ecological Development which is the foundation of this study. Two levels of characteristics, student and high school, that may influence the likelihood of gateway course success, College English I, at a rural Arkansas community college are examined. The study included 409 students from 13 secondary schools. Individual characteristics examined include high school grade point average, ACT composite of reading and English only, gender, race/ethnicity, socio-economic status, and parent education level. School characteristics examined were high school rating, racial make-up, school socio-economic status, average years of teaching experience, and school ACT average. The study used a quantitative, two-staged nested, between-subjects design using multi-level modeling with logistic regression.

Despite other studies, this analysis determined that high school attended and student characteristics of gender, race/ethnicity, SES, and parent ed level does not influence College

English I course success. However, in alignment with most studies, past academic performance measured by HS GPA and ACT score has a strong influence on the success rate. These findings should not be generalized beyond the institution in the study but may be used as a baseline for an institution examining its student population.

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CHAPTER ONE

Introduction

In this chapter, I outline how student-level and secondary school-level characteristics influence the likelihood of community college gateway course completion, specifically college English I, in rural Arkansas. The focus at many institutions of higher education is on standardized admissions exams, such as the American College Test (ACT), for admissions and course placement. So much emphasis on one test score may not be serving community college students well. Students bring a variety of characteristics with them to college, including their secondary education experience and other factors that may be considered risk factors for success in college. I discuss the influence of several factors at the individual and secondary institution levels that have gained attention as impacting college success both historically and empirically. I define each concept and guiding questions. The chapter concludes with the proposed scope and limitations of this study.

Background of Study

There are twenty-two community colleges in Arkansas, and many are in rural areas of the state (Arkansas Community Colleges [ACC], 2019). Community colleges are, by design, institutions with a more diverse student population than four-year institutions (Gulf Coast Community College, 2011) and, therefore, need to take measures to understand the unique group served. Secondary schools and community colleges can benefit from an increased understanding of college gateway course success viewed from the local context (Hein & Smerdon, 2013).

Gateway courses are entry-level college courses, such as first-level English and math (ADHE, 2018; Colvin, 2014). Arkansas community college students enrolled in a technical certificate or associate degree program must successfully complete gateway courses in English,

math, and social sciences; yet, many students are entering community colleges academically underprepared for the rigor. At two-year institutions in Arkansas, if students are not academically prepared for gateway courses then they require remediation. Remediation is defined as a student testing into, enrolling in, or being recommended to courses that do not count as college credit (Armbrust, 2015; Jenkins et al., 2009). This is necessary and helpful yet delays access to earning of college credit and lengthens the time to degree (Ngo & Kwon, 2015), as well as, adds significant time and cost and leads to discouragement of completing a college degree or certificate (Colvin, 2014; Vandal, 2014).

The National Center for Education Statistics (2018) reports 68% of students starting at two-year institutions took at least one remediation course. This is consistent with the Arkansas Department of Higher Education's (ADHE) 2015 remediation data report showing 67.2% of first-time entering students at two-year colleges, as compared to 28.8% at four-year institutions, required some level of remediation. Table 1 shows the Fall 2014 breakdown of the percentage of community college students needing remediation in the main three gateway course areas of English, reading, and math, as compared to four-year institutions.

Table 1
Need of Remediation

	Community colleges	**Four-year institution**
English	44.5%	16.5%
Reading	34.5%	12.5%
Math	48.7%	21.6%

Note: The data are adapted from the Arkansas Department of Higher Education's (ADHE) 2015 remediation data report. Retrieved from https://static.ark.org/eeuploads/adhe/publications/Remediation_Fall_AY_2014-2015.pdf

If such a high percentage of community college students are struggling to meet requirements for entry-level college courses, community college leaders need to study who these students are and the characteristics they bring with them that influence the likelihood of success; interventions and resources can then be designed to fill the gap (Hirschy et al., 2011). For instance, Hein and Smerdon (2013) discuss potential high-school-to-college bridge programs and other summer transition programs that increase the likelihood of college success. Barnett and Hughes (2010) identified three milestones that lead students to college completion: enrollment in college, college readiness at enrollment, and persistence in college. Understanding how student and secondary school characteristics affect college gateway course success could allow for secondary schools and community colleges to better design and implement programs that show students college is an option, boost student confidence, and prepare students for an educational journey leading to college completion.

Community college enrollment is dependent upon the economy and waivers alongside unemployment rates (Smith, 2018). This association is seen in enrollment data at the specific community college being studied (University of Arkansas Community College at Morrilton [UACCM], 2019) and unemployment rates in Arkansas (Bureau of Labor Statistics, n.d.) (See Figure 1)

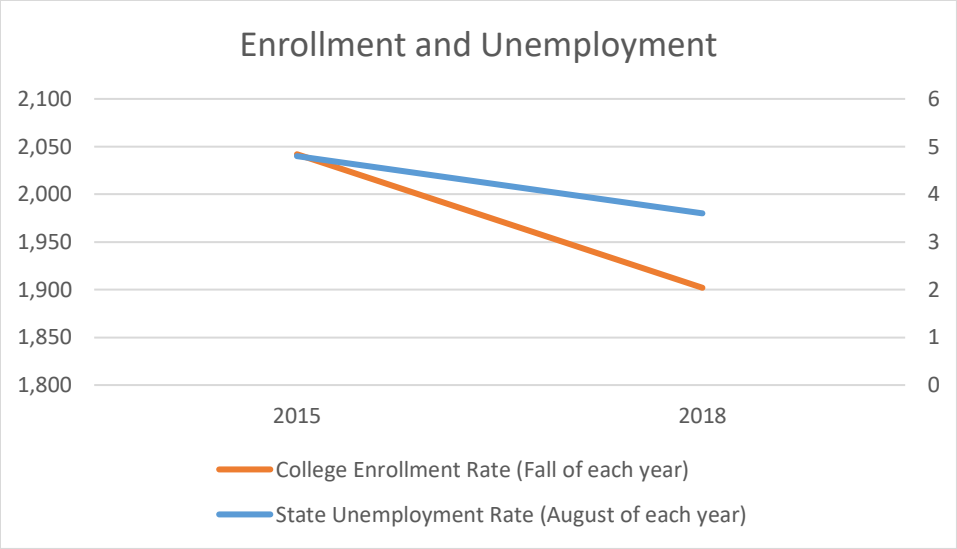

Figure 1. This figure illustrates the association between community college enrollment data and unemployment rate. As the unemployment rate decreases, so does college enrollment at community colleges.

The United States Census Bureau (2016) defines rural as any area that is not urban. Residential population density and other land use characteristics are used to define areas considered urban (Ratcliffe et al., 2016). In the United States, 97% of the land is considered rural with only 19.3% of the population residing there. In rural areas, only 19.5% of the population has earned a bachelor's degree or higher as compared to nearly one-third of the urban area population (United States Census Bureau, 2016). Students from rural schools perform at a lower level than their counterparts (Li & Dockery, 2015). Rural areas not only have a lower participation rate in the labor force but also lower educational attainment level which has been shown to result in lower earnings (Cheeseman Day et al., 2016).

Arkansas is considered a rural state with 82.7% of the counties in the state defined as rural (University of Arkansas Division of Agriculture [UADA], 2013). Census data in 2013 revealed 16% of the nation's population reside in a rural county, whereas 44% of Arkansas's population reside in a rural county (UADA, 2013). In Arkansas, 13% of those living in a rural area have a college degree as compared to 24% of Arkansans living in urban areas; both are

lower than the national average of 30% having earned a college degree (UADA, 2013) (See Figure 2). In 2010, Arkansas ranked 49th in the nation for percentage of the state's population having earned a college degree (UADA, 2013). With rural Arkansas's low educational attainment level, educational leaders and decision-makers could benefit from understanding factors that can predict student success so this gap may be addressed.

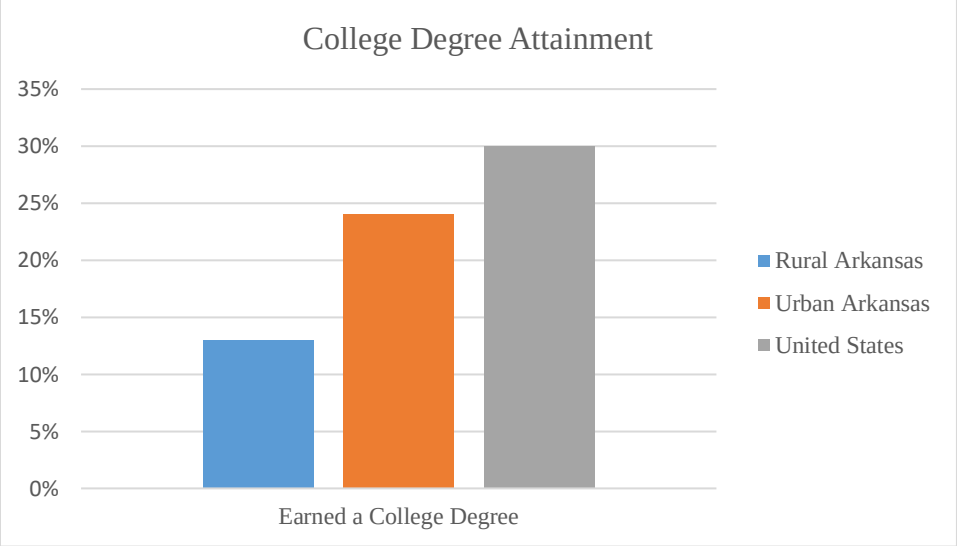

Figure 2. This figure illustrates the association between community college enrollment data and unemployment rate.

Understanding the student and school-level predictors of college gateway course completion can lead to targeted interventions being designed and implemented. The possible independent variables are numerous as students come from varying backgrounds and bring many characteristics and experiences with them to college. The independent variables for this study will include both student and secondary school characteristics with a focus on a cross-level interaction chosen based on the literature review. The dependent variable, of College English I success is chosen based on being a gateway course required as a prerequisite to other college-level courses and for certificate and degree attainment, regardless of area of study. If community college students are not completing gateway courses, they will not attain certificates and degrees.

Need and Purpose

The purpose of this study is to examine student-level and secondary school-level characteristics that may impact the completion of college gateway courses at a rural community college in central Arkansas, the University of Arkansas Community College at Morrilton (UACCM).

The importance of studying student population data for an institution is timely amid the recent implementation of productivity-based funding in Arkansas which increases the importance of institutions being accountable to stakeholders. The newly implemented funding formula consists of four areas: "Effectiveness (80% of formula), Affordability (20% of formula), Adjustments (percentage increase based on enrollment), and Efficiency (+/-2% of formula)" (ADHE, 2018, p. 4). Varying metrics exist within each area. Effectiveness measures include credentials awarded, progression of courses, transfer success, and gateway course success (ADHE, 2018). Gateway courses are one of the first indicators of student success in college (ADHE, 2018). Higher success rates in college gateway courses lead to higher degree completion rates. Success in gateway courses is particularly important regarding underprepared students, which is 67.2% of students entering community colleges (ADHE, 2015). Understanding what contributes to gateway course success assists community college faculty and staff in creating early alert systems and implementing other timely interventions, which can enhance overall student success and help retain students. According to Cheeseman Day et al. (2016), higher educational attainment usually equals higher earnings.

Role of Secondary School

Knowing the secondary school predictors that could contribute to college success provides valuable information for the design and implementation of targeted interventions (Black

et al., 2015). For instance, learning communities targeting incoming college freshmen at a New York community college have shown to provide traditional-aged, disadvantaged, underprepared students with an intervention that led to higher completion rates and higher engagement in their classes (Brock, 2010). El Paso Community College and the University of Texas at El Paso partnered with local high schools to improve college readiness by implementing a protocol exposing all students to college before high school graduation (Barnett & Hughes, 2010). The protocol includes an introduction to college, navigating the admissions process, taking college placement exams, and other related activities to prepare students (Barnett & Hughes, 2010). Targeted interventions such as this can be designed and implemented once predictors of success are determined and understood in the local context.

Community colleges serve a unique set of students with varying goals upon entering college, which do not always equate to degree completion. Students may enter to gain basic education in preparation for attending four-year institutions or completing prerequisites for various specialty areas of study rather than for degree attainment. Moore and Shulock (as cited by Hein & Smerdon, 2013, p. 10) recognized that students transferring from a two-year to a four-year institution are more likely to be successful in completing college if they are successful in college gateway courses of English and math during those first two years. Therefore, gateway course completion is an area where community colleges can make an impact on their investment of resources and energy while diligently serving students.

This study fills a gap in literature by reviewing combined demographics of students and secondary schools within rural central Arkansas, rather than focusing on large mid-western or urban institutions. This study also provides critical information to the rural Arkansas institution regarding the local student population. Li and Dockery (2015) acknowledge a gap in research

regarding secondary school-level characteristics, such as secondary school socio-economic status (SES), and college success. Each community college is unique in its own student population and communities served; however, this study considers secondary school characteristics rather than identifying specific institutions, resulting in findings that may be generalizable to other rural higher education institutions. Findings may also be valuable to secondary schools. If schools better understand the predictors of college success for their students, interventions could be implemented at the high school, such as college preparatory programs required by all students, not just those deemed as college-bound. High school students need access to rigorous courses that prepare them for college and even allow them to gain college credits while in high school (Turk, 2017). Ideally, with an increased understanding of student and secondary school predictors, both high school and community college leaders would come together to design and implement programs to increase student success in college.

Definitions

Definitions are provided to explain concepts that may be unclear or have varying explanations between or within fields. These are definitions commonly used within higher education and secondary education.

Higher education, or post-secondary, refers to education after secondary education, i.e. high school (Merriam-Webster Dictionary, 2019). I will primarily refer to community colleges, or two-year institutions when addressing higher education; at times, it may also include reference to the inclusion of four-year universities. Community colleges in Arkansas continue to be viewed as career and technical schools even though partnerships exist with four-year institutions for seamless agreements of transfer. Community colleges are typically more affordable than four-year institutions and often serve as a first step of the college journey to a bachelor's degree.

Gateway courses are entry-level college courses (ADHE, 2018; Colvin, 2014). Gateway course success typically is earning a grade of an A, B, or C. There are many courses that could be viewed as gateway courses, such as first-level courses in English, math, and reading (ADHE, 2018).

Academic preparedness does not have a common definition nor a consistently used measure (Scott-Clayton, 2012), yet it has been deemed as the number one factor in measuring college success (Burns, 2010). The American College Test (ACT) is the most commonly used admissions exam in Arkansas. The exam is designed to measure the level of knowledge mastery learned in school for college preparedness (ACT, 2018). ACT (2020) has determined benchmark scores that predict a 50% chance of earning a B and a 75% chance of earning a C. Some schools use these predetermined benchmarks as placement scores for enrollment into gateway courses while other institutions will use the benchmarks as a minimum level but will review institutional course completion data to determine institutional benchmark scores. When these benchmark scores are not met, students are enrolled in remedial courses.

High school grade point average (HS GPA) refers to the measure of academic achievement based on all grades received (Collins Dictionary, 2019). High school GPA is based on a four-point scale with A=4, B=3, C=2, D=1 (Arkansas Department of Education [ADE], 2005). With Advanced Placement classes at the secondary school level, which award grades of one point higher than the four-point scale, a student could receive higher than a 4.0 (ADE, 2005).

Throughout the paper, I use the term community (or communities). This is referring to a group of individuals that share common characteristics or are from a similar geographic area (Collins Dictionary, 2019).

Statement of the Research Problem

To best serve students and meet their academic needs, rural Arkansas institutions must understand their unique student bodies and communities served. For this reason, I will examine how student-level and secondary school-level characteristics influence the likelihood of community college gateway course completion, specifically in College English I. This course is required by all students completing an associate degree or technical certificate in Arkansas community colleges.

The following research questions will guide this study.

1. Does the likelihood of completing College English I vary across high schools?
2. Do established student-level predictors of college success influence the likelihood of completing College English I in a rural Arkansas community college?
3. Do established school-level predictors of college success explain the school-level variability in the likelihood of completing College English I in a rural Arkansas community college?
4. Does the relationship between a student's composite ACT reading and English score and his or her likelihood of completing College English I vary across high schools?
5. Does a high school's average composite ACT reading and English score predict the relationship between a student's composite ACT score and his or her likelihood of passing College English I?

Scope and Limitations

The scope of this study is rural community college students who graduated from a central Arkansas public high school in 2017 or 2018 and are attending one rural institution, the

University of Arkansas Community College at Morrilton (UACCM). The study will be completed with data collected on first-time entering students enrolled in College English I during the 2017-18 and 2018-19 academic years at UACCM. The data is limited to these two years to provide current and relevant results to the college, as well as to ensure the student data is closely connected to the secondary school data during years attended by the students. The study will focus on varying student-level characteristics, allowing for a baseline of information for others to use in reviewing their specific student populations but is primarily limited in scope to future students at the rural community college in this study. Secondary school-level characteristics are used rather than specific school districts to not identify schools that may not be academically preparing students but also to allow for better generalizability of the results.

A limitation to this study is each institution of higher education is unique and will need to use the results only as a baseline generalizing to its local context. There will be factors that could influence college success which are not controlled for, such as workload outside of school, number of children, motivations, and resiliency. Another limitation is that the instructor delivering a course has academic freedom, allowing for varying degrees of rigor between course sections offered. The gateway course in this study is part of the Arkansas Course Transfer System with set syllabi, so at minimum, the same objectives are covered within sections of the course. There is also no data recorded to separate students by course modality. Findings are limited by secondary school data access and by the length of standardized exam score validation. Public K-12 secondary schools collect data that is not accessible for homeschool or private school students. Data from the high schools will be from the 2016-17 and 2017-18 academic years to ensure the college students in the study are connected to data representing years they attended the high school.

This study defines student SES as whether a student qualified for Pell funds or not. A limitation stated by Armbrust (2015) is that not all students who may qualify for Pell apply for financial aid. This will not be a limitation to the definition for this study as all students attending college in Arkansas are required to submit a Free Application for Federal Student Aid (FAFSA®).

Summary

Gateway courses are the foundation for attaining a degree or technical certificate at a community college. Post-secondary institutions cannot increase credentials, progression, graduation, and transfer success rates without students completing foundational gateway courses. If students are not academically prepared for gateway courses, then they are enrolled in remediation, which has been shown to add significant time and cost, as well as lead to discouragement of completing a college degree or certificate (Vandal, 2014). Students from rural areas are less likely to obtain a college education; yet, it is suggested that college credential attainment leads to higher wages and higher participation levels in the labor force (Cheeseman Day et al., 2016).

Review of the literature and theory suggests each community college needs to take a holistic view of the student population within its specific, unique institution. Secondary school characteristics should also be considered as those experiences help mold students academically and will either prepare them for college successfully or leave them underprepared. If an institution can determine factors putting students at risk of not succeeding in gateway courses, interventions can be planned and implemented in a more targeted fashion. All these factors combined make it critical for an institution to be accountable, which includes understanding its students and the likelihood of success. Through understanding the student population and how

the environments interact that they live and go to school in, community colleges and secondary schools can address students' needs and increase the likelihood of college success.

The community college being studied serves a six-county area (UACCM, 2019) and accepts students with varying backgrounds and experiences. The institution is centered among two four-year public and two four-year private institutions within a 30-mile radius (UACCM, 2019), making it an affordable and accessible institution for college gateway courses. It is believed that relationships between student- and school-level characteristics can be used to predict success in gateway courses. Although there are limitations to the study, the results will serve the purpose of helping rural Arkansas two-year institutions and secondary schools have a better understanding of how complex the student population is and to be more targeted in the design and implementation of student success interventions.

CHAPTER TWO

Literature Review

In this chapter, the conceptual framework section provides information on why this study is important, defines concepts, and discusses discoveries from the review of existing literature. The relationships between concepts are discussed in detail throughout the literature review; however, a brief table summarizing findings is provided in Table 2. The theoretical framework used for this study is Bronfenbrenner's Ecological Theory of Development. Discussion surrounding the theory and how it applies to the current research is included in the literature review. Following theory discussion, research questions and hypotheses guiding the study are explained and a brief summary closes the chapter.

Conceptual Framework

Hein and Smerdon (2013) argue colleges should not look at any indicators or predictors individually, rather as part of a whole. To view predictors as a whole, one first should understand the predictors separately. These include individual characteristics (student-level) and environmental characteristics (secondary school level). The characteristics within the levels then need to be examined for interactions that further explain the outcome variance. Many interactions between variables have been suggested within the literature; however, according to Bronfenbrenner (1976), how a student learns is a function of the interaction between the learner's characteristics and the learner's environment. For this reason, this study will focus on cross-level interactions.

Student-Level Variables

Academic Preparedness.

Burns (2010) suggests that academic preparedness could be the number one predictor of college success, and not being academically prepared usually means that other individual factors may contribute to the lack of success. Academic preparedness has been defined as having the academic ability and noncognitive skills (Ngo et al., 2018), Scholastic Aptitude Test (SAT) scores combined with AP testing (Black et al., 2015), high school grades or standardized test scores (De Clercq et al., 2016), or a combination of high school grades, standardized test scores, and a determined need for remediation (Hepworth et al., 2018). In a study of Australian students, Anderton (2017) defined academic preparedness through the Australian Tertiary Admission Rank (ATAR) score, which is a calculated performance score measuring a student's secondary school performance and determined it to be the strongest predictor of success.

In this study, academic preparation is defined through student-level characteristics of standardized test scores, using the American College Test (ACT), which is designed as a measure of the level of knowledge mastery learned in school for college preparedness (ACT, 2018) and high school grade point average (HS GPA). Colvin (2014) defined ACT as a standardized admissions test using a score as a measure of knowledge and readiness, which colleges use for course placement. Furthering these definitions, the ACT includes English, reading, math, and science subset scores (Barkley & Frost, 2004).

Colvin (2014) suggests that using ACT alone can lead to the misplacement of students in college gateway courses. One issue discussed in Colvin's research is how some high schools may coach students toward the standardized exams, leading to students being good at multiple-choice tests or prepped on test-taking tips, both which can lead to inflated test scores. According

to the Organization for Economic Cooperation and Development (OECD) Programme for International Student Assessment, the majority of variance in student standardized test scores occurs at the secondary school level (as cited by Li & Dockery, 2015, p. 77). The ACT is not aligned with secondary or post-secondary curriculum, which is an issue when these tests are used for college admission and course placement. This misalignment leaves a higher number of students seemingly not prepared for college and requiring remedial courses that do not earn college credit (Colvin, 2014). Other standardized exams are used for course placement and college admissions, and some of that research is also presented in this literature review.

Belfield and Crosta (2012), using standardized exams other than the ACT, found no significant predictive ability on college performance of standardized test scores alone, only a weak association which disappeared once high school grades were considered. Although there was no significance found in relationship to standard definitions of student success, even after controlling for grades, Belfield and Crosta (2012) determined the presence of a relationship between test scores and accumulated credits.

Other studies also determined no relationship between the passing of college-level reading and English and writing scores when looking at non-ACT standardized exams (Jenkins et al., 2009; Ngo et al, 2018). Jenkins et al. (2009) broke test scores into four quartiles to estimate the relationship with the passing of the gatekeeper English course. After controlling for student characteristics and the secondary institution, the analysis resulted in nearly equal probability across test quartiles predicting no relationships between reading or writing scores and passing English gatekeeper courses (Jenkins et al., 2009). The Jenkins et al. (2009) Summary Report does not go into detail about their study; however, the full report explains that the dataset used included a large number of students with missing test scores in one or more areas (Roksa et

al., 2009); therefore, the results of no significance for this study should be taken with light consideration.

Barkley and Frost (2004) completed a study with Kansas State University agricultural students using the ACT composite and four subset scores. The study ran a regression model including sociodemographic variables, such as age, gender, ethnicity, and family income, as well as school-level variables, such as high school quality, average teacher salary, and pupil to teacher ratios. The model explained 48% of the variance in the outcome of the first-semester college GPA of university students studying agriculture. Of this variance, 9.8% was explained by ACT composite score. The second-semester college GPA was slightly less explained by ACT at only 2.1%. When Barkley and Frost (2004) ran separate regression models for each of the subset scores, English explained 9.1% of the variance in first-semester GPA, and reading explained 4.4%. Although lower predictability, the second-semester GPA regression models using subset scores resulted in 3.1% of variance explained by English scores and 1.0% by reading scores (Barkley & Frost, 2004). To take a fresh view of ACT score predictability of success and to incorporate the above explained findings, ACT will be defined by a composite score using the ACT Reading and English subset scores.

The Arkansas Department of Higher Education (2018), in accordance with A.C.A. §6-61-110, recommends institutions use multiple measures for course placement. One such potential measure that has most often been recognized as the strongest predictor value for varying measures of post-secondary success, including attrition, retention, persistence, and graduation, is HS GPA (Anderton 2017; Belfield & Crosta, 2012; Fletcher & Tienda, 2010; Kim, 2015; Li & Dockery, 2015). This predictor was the only single variable found significant to retention (Kim, 2015). Turk (2017) ran a probit regression model, including demographics and past academic

performance, finding a one-point increase in HS GPA increased the probability of completing a credential by 25.3%. Barkley and Frost (2004) looked at the overall HS GPA, as well as specific courses of English, math, natural science, and social science. They determined HS GPA to be the strongest single predictor, explaining 12.9% of the variation in first-semester college GPA. The four individual courses combined accounted for 14.6% of the variation in first-semester college GPA and 7.8% of the variation in second-semester college GPA. Wolniak and Engberg (2010) determined in their study that HS GPA had the strongest predictor value of any individual characteristic, and its effect increased as the high school constructs were added to the model. Hein and Smerdon (2013) and Woods (2016) argue having at least a 3.0 HS GPA increases likelihood of post-secondary success. Woods (2016) goes further to suggest that students with a 2.0-2.9 HS GPA may require remediation to be successful in college courses. Cyrenne and Chan (2012) determined that although HS GPA is a strong predictor, there are other factors that intensify the relationship between HS GPA and college performance, such as financial need and expenditures per student at the high school attended.

The combination of standardized test scores and HS GPA have been determined as the strongest predictors of post-secondary success as measured by persistence, retention, and/or graduation (Hepworth et al., 2018; Kim, 2015; Sackett et al., 2009; Wolniak & Engberg, 2010; Woods, 2016). In the 2018 Hepworth et al. study, they defined academic preparedness as a calculated score including HS GPA, ACT score, and need for remediation. They used ordinal logistic regression to test the predictability of academic preparedness on completion of a criminal justice gateway course. Their findings show that as the academic preparedness measure increased, so did the likelihood of receiving an A while the likelihood of getting a failing or withdrawal grade decreased. Despite the growing literature on the predictive validity of high

school grades on success in college, many institutions are still hesitant to use these measures due to the lack of consistency in grades across secondary institutions (Ngo & Kwon, 2015).

Race/Ethnicity.

Race/ethnicity is commonly defined by self-reported data. Race/ethnicity of students serves as a predictor of student success, but direction varies across studies. In Fletcher and Tienda's 2009 study of students at the University of Texas at Austin, it was determined, after controlling for time-invariant high school factors, black and Hispanic students outperform white students and the gap between white students and Asian students disappears. These results contradict what other researchers have found where white students outperform both black and Hispanic students (Colvin, 2014; Mertes & Hoover, 2014; Wolniak & Engberg, 2010). Wolniak & Engberg (2010) completed a blocked linear regression model finding black and Hispanic students performed significantly lower than white students. However, once class rank and test scores were controlled for, the gap between white and black students decreased by 75% and between white and Hispanic students by 70% (Wolniak & Engberg, 2010). Pike et al. (2014) ran a multiple imputation logistic regression to account for missing data in their study; they determined black students had an odds ratio of less than half that of white students in graduating within four years. Turk (2017) ran probit regression models and found when looking at demographics that only Asian/Pacific Island students were 6.9% more likely to earn a credential than white students, although white students had a higher probability than all other races. In this same study, a second model that included pre-college academic measures, the findings regarding race were very similar although deemed less significant (Turk, 2017). Wolniak and Engberg (2010) found some of the racial variance could be attributed to the quality of high school

attended as white and Asian students typically attend higher-quality schools than black or Hispanic students.

Gender

Historically, literature has shown gender as a predictive factor for college success with females outperforming males (Anderton, 2017; Clotfelter et al., 2013; Fleming et al., 2018; Fletcher & Tienda, 2009; Li & Dockery, 2015; Mertes & Hoover, 2014; Wolniak & Engberg, 2010; Woods, 2016). Research as far back as the 1940s found that females were outperforming males even though there was a higher number of men in college at the time (Pabst, 1965). When considering only gender, women are 12% more likely to complete a credential than men, but when considering past academic performance, the probability decreases to 6.8% (Turk, 2017). Woods (2016) suggests the differences in success by gender could be contributable to the attitude differences between men and women and how they experience college. Wintre et al. (2011) found gender to be significant, with men being 1.733 times more likely to maintain HS GPA in college; however, the authors pointed out that those results should be taken with light consideration as Wintre's own past research with others shows women are often more likely to be retained and to graduate.

Kim (2015) argues that gender's effect is inconclusive. Other studies found no significance between genders when measuring the associate of applied science degree completion, yet men outperform women within certificate programs (Armbrust, 2015). Armbrust (2015) suggests this could be attributed to females not being as well versed in technical skills required by certificate programs. In the data analyzed by Armbrust (2015), there was a large increase of women enrolling in certificate programs for more recent years. Although women still had a lower likelihood (odds ratio of .500) of completing a certificate program. There was no discussion of what took place to increase enrollment in the 2015 study by Armbrust and if that

somehow created an advantage toward men for completion. In Anderton's 2017 study of allied health and science programs, women outperformed men, with a .227 higher college freshman GPA.

Student Socio-Economic Status

Student socio-economic status (SES) has been defined by using resources available to students based on family income and parent education level (De Clercq et al., 2016; Sackett et al., 2009; Turk, 2017), parent income and type of financial aid received (Woods, 2016), socio-economic classification of the residence zip code (Anderton, 2017; Fleming et al., 2018), and Pell funds status (Armbrust, 2015; Kim, 2015). This study defines student SES as whether a student qualified for Pell funds or not. The majority of the literature reveals a moderate to strong relationship to student success with students from lower SES having a lower academic performance (Black et al., 2015; Clotfelter et al., 2013; Cyrenne & Chan, 2012; Fike & Fike, 2008; Fleming et al., 2018; Pike et al., 2014; Wolniak & Engberg, 2010; Woods, 2016) with Li and Dockery (2015) determining SES could be more significant even than academic performance. Turk (2017) ran five probit regression models, and, in all models, student SES was determined as a significant predictor of earning a credential. In the 2017 Turk study, SES included income and parent education and occupation, all weighted equally; when only looking at this weighted measure, a one-point increase meant a 7.3% increase in the probability of completing a credential. When Turk (2017) added past academic performance measures into the model, student SES was still significant with a 5.1% increase in the probability of credential completion.

A unique finding from Goldrick-Rab (2010) suggests that middle-class students may benefit the most from community college settings; this will not be addressed in this study due to

lack of access to a continuous variable measuring student SES. Seeming to conflict with most studies, Ishitani and DesJardins (as cited by Kim, 2015, p. 53) found that students receiving Pell were less likely to drop out of college than those not receiving aid (Kim, 2015). Armbrust (2015) had similar findings with Pell as a significant predictor recognizing that students who receive Pell are less likely to be retained or earn a certificate (odds ratio of .181) than those receiving Pell and enrolled in an Associate's of Applied Science program (odds ratio of .577). That conflicts with what one may think since certificate programs are shorter and do not have the same general education requirements (Armbrust, 2015). A potential issue with these findings is it is not determined if the college in the study offers stackable credentials, if they encourage students to graduate at all levels, or only at the levels they have listed as the goal. Mertes and Hoover (2014) found receiving financial aid as not significant for one group yet was predictive for the second group. Other studies deem individual SES to have little to no direct effect of significance on college success (Li & Dockery, 2015; Sackett et al., 2009). Sackett et al. (2009) confirmed through re-testing others' models that, although SES has no direct influence on post-secondary grades, SES does have a predictive ability on standardized test scores; since test scores are influenced by SES, and test scores predict grades, there is an indirect influence between SES and grades.

Parent Education Level

Prior studies have defined parent education level in varying ways, such as only the mother's education level (Black et al., 2015), only the father's education level (Wintre et al., 2011), and the highest level of education of either parent (Woods, 2016). For this study, the definition of parent education level will follow the college's admission application, which asks if

either parent has a college degree or certificate, which most closely follows Wood's (2016) definition.

Research strongly suggests as the parent education level increases, the likelihood of student achievement increases, and having a parent with no college experience usually results in a lower GPA (Fengliang et al., 2015; Fletcher & Tienda, 2009; Wintre et al., 2011; Wolniak & Engberg, 2010; Woods, 2016; Yazedjian et al., 2009). Wintre et al. (2011) acknowledged these results are supportive of a lifetime perspective that one's experiences early in life can influence successes or failures later in life. Some researchers believe the correlation between parent education level and college success could be due to the fact that parents with a higher education level tend to focus on cultivating their child's aspirations, are more involved in their education, make better school choices, and provide more support than those with less education (Egalite, 2016; Yazedjian et al., 2009). A study completed in China found a positive association between both mother and father's education level and college success, as measured by standardized college English exams (Fengliang et al., 2015). For each additional year of the father's and mother's education level, there was a 0.8% and 0.5% increase, respectively, of passing the college English exam (Fengliang et al., 2015). Yazedjian et al. (2009) found a significant correlation between parent education level for white students, but not for Hispanic students. Their research was completed at a four-year public institution with mainly highly educated parents.

Few researchers have found conflicting results; however, Mertes and Hoover (2014) determined parent education level as not significant in their study through a chi-square analysis. Due to missing data for this variable, they were unable to include it in their logistic regression model, which may have provided different findings as a more appropriate model. Fike and Fike

(2008) determined the mother's education level has no effect on retention levels. However, there was a large amount of missing data regarding parent education level, and all missing data was coded as having not attended college; this could have biased their findings.

School-Level Variables

Quality and intensity of secondary curriculum may affect almost every dimension of post-secondary education, even when controlling for student-level traits (Kuh et al., 2006; Pike et al., 2014) and has been deemed as the strongest school-level predictor (Lowman & Elliott, 2010); however, there is a gap in the literature looking at how the high school attended may predict completion of college gateway courses. Woods (2016) suggests that secondary schools are responsible for college preparation or lack thereof. Therefore, it is important to review a second level of variables, which are the high school characteristics.

High School Quality

High school quality affects nearly every aspect of college success, even when controlling for the student characteristics (Kuh et al., 2006; Pike et al., 2014). Literature has defined high school quality based on factors that could influence the quality and resources available to students, such as type of high school, which also means type of funding for the high school (Anderton, 2017; Fleming et al., 2018), per-student expenditures (Armbrust, 2015; Black et al., 2015; Clotfelter et al., 2013; Cyrenne & Chan, 2012; Li & Dockery, 2015), average teacher experience (Black et al., 2015; Cyrenne & Chan, 2012), pupil-educator ratio (Armbrust, 2015), and rural/urban designation/size of school (Black et al., 2015; Clotfelter et al., 2013; Wolniak & Engberg, 2010). Black et al. (2015) also considered the percentage of special education students as a factor of quality since this could influence the amount of funding spent on regular academic programs. Arkansas measures high school quality through an annual performance report that is

aligned with the Every Student Succeeds Act of 2013. This measure takes into account achievement, growth, graduation rate, English learner progress, and school quality/student success indicators.

Fletcher and Tienda's 2009 and 2010 studies both argue that after controlling for individual academic achievement and family SES, the influence of high school quality may not be eliminated. They argue high school quality contributes to the ethnic gaps in college success and performance. High school quality affects academic performance post-secondary, even when controlling for individual grades and test scores (Fletcher & Tienda, 2009, 2010). The quality of the high school attended varies among minorities and non-minorities, and even when the effect of race is controlled for, high school quality still serves as a predictor (Fletcher & Tienda, 2009, 2010). A simple linear model predicted the high school attended and the class ranks to explain 16% of variance in college graduation rates as compared to ACT math and reading scores explaining only 5% (Arcidiacono & Koedel, 2014). High school quality has an effect regardless of how quality is estimated; these effects persist throughout college, with the highest effect on college GPAs of sophomores and juniors (Black et al., 2015). Students who move from lower quality to higher-quality schools, as measured by socio-economic status, academic preparation for college, and school resources, tend to experience meaningful gains in academic preparation, which leads to a higher likelihood of degree completion (Black et al., 2015). Even though school resources may lead to higher likelihood of college success, per student expenditures at the high school was not found to have a significant direct effect (Black et al., 2015; Clotfelter et al., 2013; Li & Dockery, 2015). Cyrenne and Chan (2012) suggest that although there is no direct effect, the amount a secondary school spends per student appears to have a positive interaction with community SES, HS GPA, and financial need.

Average years of teaching experience at the high school is part of defining high school quality (Black et al., 2015; Cyrenne & Chan, 2012). Average years of teaching experience has a small association with students' academic performance in college measured by GPA (Black et al., 2015). When controlling for student characteristics, higher average years of teaching experience led to higher performing students, and, controlling for student characteristics or not, there was still a positive effect found for females, high SES students, and Hispanic students, but not black students or white students (Black et al., 2015). Cyrenne and Chan (2012) did not specifically use teacher experience as a variable but did suggest from their review of literature that researchers have determined high school teaching experience level has a small effect on university GPA.

Average Academic Performance

Average academic performance has been defined by average test scores (Li & Dockery, 2015; Woods, 2016) and average high school grades (Black et al., 2015; Li & Dockery, 2015). It has been suggested with the SAT, which is a standardized test similar to ACT, that institutions should not look only at individual scores but also concern themselves with where a student's score ranks within the secondary school attended (Kostal et al., 2017). For the purposes of this study, the average academic performance of a secondary school will focus on average ACT scores in Reading and English. This is the average ACT subset scores of seniors taking the ACT at the secondary school during the year (ADE, 2017). Many studies reviewed other standardized test scores that are similar to the ACT; those studies will also be reviewed.

In Australia, the Organization for Economic Cooperation and Development's (OECD) Programme for International Student Assessment (PISA) reveals a significant portion of the variance in student standardized test scores occurs at the school-level; in the 2005 and 2009

PISAs, one-third and one-fourth, respectively, of variance is at the school-level (as cited by Li and Dockery, 2015, p. 77). Secondary schools with higher-performing students tend to result in higher performance post-secondary (Li & Dockery, 2015). Woods (2016) also argues that some high schools do a better job preparing students for college-level work. Royster et al. (2015) suggests that not all schools have the capacity to provide rigorous coursework to adequately prepare students for college. After controlling for grades and a host of other student-level factors, almost a full grade point difference between higher-performing school students and lower-performing school students remains (Cyrenne & Chan, 2012).

School Socio-Economic Status (SES)

The literature reviewed defined school SES as the percent of students on free/reduced lunch (Black et al., 2015) and as measured by the Index of Community Socioeconomic Advantage, which incorporates multiple measures at the individual and community level (Li & Dockery, 2015). The ADE publicizes a school report card for each district and school, which includes the percentage of students considered low-income. This is defined by the percentage of students on free/reduced lunch.

School-level SES historically is thought to have a higher effect on college performance than individual SES (Black et al., 2015; Li & Dockery, 2015). A potential effect is seen when changes in the high school are made, which leads one to see differences are not just across high schools but within and between varying factors. When controlling for student characteristics, students from higher SES schools were the higher-performing students (Black et al., 2015). Regardless of controlling for student characteristics, SES has a negative effect on performance, more so even for females than males and on students of low family SES (Black et al., 2015). The negative effect could be explained by lack of resources available to students attending lower SES

schools, which may be reflected through fewer opportunities and lower confidence in abilities (De Clercq et al., 2016) or that schools with high poverty levels struggle to attract and retain strong, qualified teachers (Royster et al., 2015). Li and Dockery (2015) found contradictory results with lower SES schools having students that fare marginally better. However, the relationship with school SES and academic performance was minimal, the significance of school SES more than doubled when using a varying coefficients model to include school characteristics. Their conclusion could be because higher SES schools in Australia may inflate students' grades to increase availability to college as prior academic performance is a widely used factor in college admissions (Li & Dockery, 2015).

Racial/Ethnic Makeup

When reviewing literature regarding the racial/ethnic makeup of schools and the effect on college performance, there was a common theme relating to high school quality and SES. White and Asian students attended higher quality schools while black students attended lower-quality schools. Both black and Hispanic students attend schools with lower amounts of resources (Arcidiacono & Koedel, 2014; Wolniak & Engberg, 2010). The racial gap in education has been noted to begin as early as kindergarten (Letukas, 2016).

Arcidiacono and Koedel (2014) ran a k-means cluster analysis to break their dataset into clusters. They then ran a multivariate analysis of variance to get their final clustering solution and finished with an analysis of variance and descriptive statistics for comparison of their college success outcome measure, GPA. Their results found a graduation gap based on race in Missouri universities of 15 percentage points for females and 18 percentage points for males. Their research also suggests the racial gap can be partly explained by the quality of the school varying among predominantly black schools versus white schools; if leveling the field by re-sorting

students to equivalent schools, the graduation gap between black students and white students lessened by 2.8 percentage points and 1.5 percentage points respectively (Arcidiacono & Koedel, 2014).

Fletcher and Tienda (2010) discovered in their research that a racial gap was not present when running a fixed-effects model, which resulted in minority students outperforming white students from the same schools. Regardless of controlling for student characteristics, there is a negative association between high school racial make-up and college success, with males more highly influenced than females (Black et al., 2015). Armbrust (2015) argues that racial composition stands to be further investigated due to the growing population of minorities in America.

Gateway Course Completion

Graduation rates have long been used to measure community college success. This is not the most accurate measure as it does not match with the uniqueness of community college student goals as not all are seeking a degree (Burns, 2010). The literature reviewed on post-secondary academic performance is commonly studied from the perspectives of retaining and graduating students, while few studies examined student- and school-level variables regarding gateway course completion, especially in English. Gateway course completion is defined as earning an A, B, or C in entry-level college courses (ADHE, 2018; Colvin, 2014). Gateway courses have been defined more specifically as college-level courses in English and math (Jenkins et al., 2009). Historically, little research has been done on why students are not completing courses, but Bloemer et al. (2017) recognizes that gateway courses are strongly connected to degree completion and suggest courses with the highest fail rates should be reviewed.

Relationship Between Concepts

How academically prepared students are for college may be highly related to the secondary school attended, and how well the school can prepare students may be related to factors such as socio-economic status and racial make-up of the high school and community, among varying individual factors (Ngo et al., 2018). In order to best summarize the relationship between concepts, I am including a table of findings, Table 2. I include the author(s) of the research, dependent variables (DV), participants, study type when available, and a brief summary of the study's findings. The table will focus on relationships but includes some findings that are single factors of critical importance.

Table 2

Relationship between concepts

Article and Variable(s)	If Available, Who and What	Summary of Findings
Anderton (2017) *DV: grades*	• First year students at University of Notre Dame in Australia and in only six of the majors, primarily health related. • Independent t-tests, Spearman's Rho, Cohen's d, logistic regression. • Removed non-significant factors one at a time until full model determined.	• HS GPA is heavily influenced by factors such as SES and parent education level. • SES is weakly correlated to academic performance and type of high school attended as a predictive quality. • Females outperform males.
Arcidiacono and Koedel (2014) *DV: graduation*	• First-time, full-time, non-transfer, in-state Missouri University students. • Did not look at community college attendance prior to four-year enrollment. • Linear model.	• Gaps between races are partially explained by differences in high school quality. • High school attended and class rank explains a higher percentage of variance than ACT math and reading scores. • 25% of variation in high school quality can be explained by concepts found in census data.

Table 2 (Cont'd)

Article and Variable(s)	If Available, Who and What	Summary of Findings
Armbrust (2015) *DV: degree completion*	• Archived data from large midwestern community college. • Logistic regression model.	• Racial composition stands to be further investigated • Race, ethnicity, and SES are a strong predictors in requiring and completing remediation. • Students receiving Pell and working toward a technical certificate are less likely to be retained and graduate than those receiving Pell and working on an A.A.S. degree.
Barkley and Frost (2004) *DV: First-semester and second-semester grades*	• Kansas State University students attending in 1990-1999. • Regression Model	• Age, gender, and income not associated with first-semester grades. • Reading and English test scores account for a combined 13.5% of the variation in first-semester grades. • HS GPA accounts for 12.9% of the variation in first-semester grades, but individual course grades accounted for 27.5%.
Belfield and Crosta (2012) *DV: course grades/college performance*	• Students from a statewide community college system. • Completed correlations and a formal framework by Scott-Clayton (2012).	• Using HS GPA instead of test scores reduces course placement error by half. • Combining exam scores and HS GPA did not make for better placement predictive power than HS GPA alone. • Standardized exam scores for placement resulted in a 27-33% misplacement in English.
Black, Lincove, Cullinane, and Veron (2015) *DV: First-year GPA*	• A single elite, public university which only admitted students from the top 10% of the high school graduating class. • Regression analysis and Multi-level Modeling.	• Predictors' effect carries through junior year of college; teacher experience and testing effects carry through senior year. • HS SES, academic preparation, and resources are related to college performance. • Racial make-up and gender interact. • Gender and school SES interact. • Average teacher experience interacts with gender, SES, and race.
Burns (2010) *DV: Not applicable*	• Literature review.	• Students most likely to succeed have high academic preparation in high school, are from higher SES families and communities, and have parents with a college education. • Course completion predictors include race, age, and HS GPA. • High schools in lower-income communities are more have limited resources, which may lead to less likelihood of college success.

Table 2 (Cont'd)

Article and Variable(s)	If Available, Who and What	Summary of Findings
Clotfelter, Ladd, Muschkin, and Vigdor (2013) *DV: Transfer success and applied success (earned degree or diploma)*	• North Carolina community college students. • Factors based on state's Student's Right to Know Act. • Regression model.	• Variation across institutions partly contributed to student characteristics. • Females outperform males. • Parent education level interacts with major. • SES has a moderate effect.
Colvin (2014) *DV: College math course*	• Students at Snead State Community College enrolled in Intermediate Algebra or Pre-Calculus Algebra. • Logistic regression.	• Success measured by a course grade can vary considerably by student-level characteristics. • High school attended and past academics influence standardized test scores. • Possibility gender and race are associated with standardized test scores.
Cyrenne and Chan (2012) *DV: college academic performance*	• University of Winnipeg students from 84 different Manitoba high schools. • Least squares dummy variables and Hierarchical Linear Model.	• Low SES makes college success less likely. • Per student expenditure interacts with community SES, HS GPA, and student SES. • HS GPA is a strong predictor of college GPA, but many factors influence that relationship. • High school quality has significant effects with almost full grade point difference between high and low performing schools.
De Clercq, Galand, and Frenay (2016) *DV: First-year GPA*	• Belgium students. • k-means clustering and analysis of variance.	• SES has a negative effect on success and could be explained by a lack of resources available to students attending lower SES schools.
Fike and Fike (2018) *DV: retention*	• Texas public urban community college student data, N=9,200. • Multivariate logistic regression with several other tests to check for associations.	• Mother's education level has no predictive significance on retention. • Students receiving financial aid graduate at lower rates than those not on aid. • Overall, age, gender, and ethnicity have no significant effect on retention.
Fleming, Lavertu, and Crawford (2018) *DV: GPA and graduation*	• Students that attend public and private high schools. • Ordinary least squares regression model.	• Females had 0.22 higher GPAs than males. • Medium- and high-income families outperform lower-income families.
Fletcher and Tienda (2009) *DV: GPA and persistence*	• University of Texas at Austin students. • Instrumental variables-fixed-effects estimation strategy.	• After controlling for individual academic achievement and family SES, the influence of HS quality may not be eliminated. • High school quality contributes to ethnic gaps in college performance.

Table 2 (Cont'd)

Article and Variable(s)	If Available, Who and What	Summary of Findings
Fletcher and Tienda (2010) *DV: GPA*	• Ten years of data from four Texas public universities, two of which are of the most selective. • Linear regression.	• Race/ethnicity gaps have a high interaction with high school attended. • Precollege disadvantages exist throughout college career.
Hein and Smerdon (2013) *DV: Not applicable*	• Informational brief.	• Having at least a 3.0 HS GPA increases likelihood of post-secondary success. • HS GPA and test scores are strong indicators of college success.
Hepworth, Littlepage, and Hancock (2018) *DV: Introduction to Criminal Justice Course grade*	• Over 10,000 freshmen at a public residential university in western Kentucky. • Ordinal logistic regression used.	• Combining test scores, HS GPA, and the need for remediation is significant in predicting success. • One unit increase in academic preparedness equals 0.335 increase in probability of higher grade.
Jenkins, Jaggars, and Roksas (2009) *DV: Remedial progression of courses*	• Over 24,000 first-time college students in Virginia's community colleges.	• Reading and writing scores did not predict success in English (results to be taken lightly due to a large amount of missing data).
Kim (2015) *DV: First-year GPA*	• Public, mid-western university. • Statistical and inferential statistics and multiple regression.	• HS GPA and ACT score are significant when controlling for gender, ethnicity, and Pell status.
Letukas (2016) *DV: Not applicable*	• Literature review.	• Social disparities exist in HS GPA, class rank, test scores, and high school rigor. • The larger concerns may be the SES and race of students.
Li and Dockery (2015) *DV: Weighted average in first-year grades*	• Students from one Australian university admitted based on high school academic performance. • Regression analysis.	• Significant variance in student standardized test scores occurs at the high school level. • Higher-performing schools have higher-performing students in college. • School SES role is moderate. • Lower SES schools' students perform marginally better, higher effect when controlling for high school academics. • Student-level SES has very mild, almost no significant effect. • Past academic performance is a strong predictor of college performance.

Table 2 (Cont'd)

Article and Variable(s)	If Available, Who and What	Summary of Findings
Mertes and Hoover (2014) *DV: Retention and grade in foundational computer course*	• First-time entering students at rural mid-western community college. • Chi-square analysis, Pearson correlation, and logistic regression used to identify combination of variables (forward step-wise approach suggested by Feldman, which allowed for selection of variables based on level of importance).	• For most variables, results were mixed between the two cohorts. • Females outperform males. • White students outperform black students and Hispanic students.
Ngo, Chi, and So Yun Park (2018) *DV: Math grade*	• Large, urban community college district in California. • Linear probability regression model	• Student background variables are better predictors than standardized test scores alone.
Ngo and Kwon (2015) *DV: Math course and credits earned*	• Los Angeles Community College District data. • Linear probability regression model.	• Using measures such as high school transcripts better predict success than exam scores alone.
Pike, Hansen, and Childress (2014) *DV: Persistence and graduation*	• Urban, Midwest research university. • Logistic regression.	• Pre-college characteristics and high school experiences are significantly related to persistence and graduation rates.
Sackett, Kuncel, Arneson, Cooper, and Waters (2009) *DV: Grades*	• Large and small schools across 41 schools and three cohorts • Public and private institutions with varying SAT requirements. • Meta-analysis.	• Multiple indicators of student SES had better predictive characteristics than single factors but remained minimal impact. • Test scores are predictive of post-secondary grades. • Student SES influences test scores and test scores predicts grades, but SES does not have a direct influence on grades.
Scott-Clayton (2012) *DV: English and math courses*	• First-time entrants to a large, urban community college system. • Correlation coefficients, R-squared values, and calculated placement accuracy rates. •	• Standardized exams are better at predicting success than failure. • Combining HS GPA, standardized exam scores, years since high school graduation, and whether the student graduated high school locally was the best predictor of placement accuracy.
Wintre, Dilouya, Pancer, Pratt, Birnie-Lefeovitch, Polivy and Adam (2011) *DV: First-year GPA*	• Surveys were completed, so data is self-report. • Binary logistic regression.	• Males are 1.733 times more likely to maintain HS GPA in college. • As father's education level increased, so did that student's chances of maintaining GPA. • Mother's education and SES were not significant.

Table 2 (Cont'd)

Article and Variable(s)	If Available, Who and What	Summary of Findings
Wolniak and Engberg (2010) *DV: First-year GPA*	• Elite universities, first-time entering freshman. • Descriptive statistics, one-way ANOVA, blocked linear regression, and number of statistical tests to test for violations.	• HS GPA and ACT became more prominent when adding high school constructs to the model. • College achievement is influenced by both student and school-level characteristics. • Type of high school attended has a lasting effect but possibly more so when interacting with SES. • Race interacts with class rank, standardized test scores, and high school quality.
Yazedjian, Toews, and Navarro (2009) *DV: College GPA*	• Four-year public university in Texas • Correlational analyses using Pearson correlations	• Parents having no colleges leads to lower college GPAs. • There is a significant correlation between parent education level and college success. • Interacts with race/ethnicity.

A common theme throughout the literature reviewed is the significance of past academic performance as measured by high school GPA and standardized exam scores. Barkley and Frost (2004) and Ngo and Kwon (2015) took a slightly different approach by looking at specific course grades rather than cumulative HS GPA. This view may be more accepted by community college administrators as specific grades would decrease likelihood of inflated HS GPAs due to low-rigor courses taken by some students and would be focused on specific courses directly related to the gateway courses. Regardless of other predictors, high school quality, or high school attended, plays a significant role on multiple measures of college success with lasting effects throughout one's college career (Arcidiacono & Koedel, 2014; Black et al., 2015; Colvin, 2014; Cyrenne & Chan, 2012; Fletcher & Tienda, 2009, 2010; Kuh et al., 2006; Li & Dockery, 2015; Pike et al., 2014; Wolniak & Engberg, 2010). Standardized writing and reading exam scores were not predictive of English completion (Belfield & Crosta, 2012; Jenkins et al., 2009, Ngo et al., 2018) which is outside of expectations with these standardized exams being used for admissions and placement. Also, ACT has determined benchmark scores, commonly used for course placement,

which predict a 50% chance of earning a B and a 75% chance of earning a C (ACT, 2020). One could conclude the studies finding these scores as unpredictive may not have been using ACT exams scores, used placement scores outside of the determined benchmarks, or did not consider other factors that may be impacting the results.

Several interactions were found throughout the literature. Anderton (2017) determined that HS GPA is heavily influenced by student SES and parent education level. Black et al. (2015) found several cross-level interactions such as the high school racial make-up being a predictor for males, college success for females is affected by school SES, and average years teaching experience had a significant impact on females, students of high SES, and Hispanic students. Regardless of other factors, student SES has a high predictive value (Black et al., 2015, Clotfelter et al., 2013; Cyrenne & Chan, 2012; Fike & Fike, 2008; Fleming et al., 2018; Pike et al., 2014; Wolniak & Engberg, 2010; Woods, 2016) and possibly more so than past academic performance (Li & Dockery, 2015; Turk, 2017). It was also suggested that where a student's score ranks within the secondary school attended may be a better predictor than looking at the student scores alone (Kostal et al., 2017). Yazedjian et al. (2009) determined that parent education level has a significant correlation with college success, but the significance level is dependent on the race of the student.

Theoretical Framework

Inconclusive results from the literature may stem from using theoretical frameworks that are not fully measured within the studies or which do not fully lend themselves to the direction of the study. Although not found in research on college performance, Bronfenbrenner's Ecological Theory of Development, later named Bioecological Theory, explains the importance of understanding the student population and how the environments they live and go to school in

interact. This theoretical framework requires the researcher to look beyond the immediate situation of the subject into the varying contexts in which a person exists and the interactions within and between those contexts (Bronfenbrenner, 1975, 1976, 1977).

The Ecological Theory of Development is made up of systems and begin with the individual in the center. The theory describes how these systems, or layers, interact, and the relationship or effects on the individual. It begins with an individual, or student, who has certain characteristics, such as age, race, gender, and health. In order from the individual, layers are the micro-, meso-, exo- and macro-systems (Bronfenbrenner, 1975, 1977, 1986). The micro-system is the complex relationship between an individual and the immediate environment in which he/she lives, works, attends school, and so forth (Bronfenbrenner, 1975, 1976, 1977). This system includes the secondary school and home environments. The meso-system is a system of micro-systems that encompasses interactions among varying settings of an individual at a specified point in life (Bronfenbrenner, 1976, 1977). For instance, how the home and school environments interact with each other. The exo-system is extended from the meso-system but includes settings the individual is not directly in, rather settings that influence or have an impact on the immediate setting of the individual (Bronfenbrenner, 1976, 1977). This could include sectors such as informal social networks, government, schools, neighborhoods, or mass media, and represent a level of higher-order effects. The macro-system is the largest concept which includes the above-mentioned systems and is the blueprint for the other systems and refers to the overarching culture or ideologies the systems are found within (Bronfenbrenner, 1977). Later, a chronosystem was added to consider time; this system includes the changes a person and his/her environments go through over time and the interactions between those (Bronfenbrenner, 1986). One could also view the chronosystem as life transitions, such as beginning school or graduation

from school, normative transitions, or death and divorce, non-normative transitions (Bronfenbrenner, 1986). These systems interact to form the individual (Bronfenbrenner, 1975, 1976, 1977, 1986).

This design of this study is in consideration of Bronfenbrenner's Ecological Theory of Development (see Figure 3). The success of a student in college should be studied through an ecological lens as students are individuals living and interacting within multiple environments. Students bring individual characteristics with them, such as age, gender, and race. They also bring characteristics with them based upon the environments they interact within, such as the secondary school attended, family, and community in which they were raised; or in some cases, the multitude of family, communities, and schools attended and lived within (Bronfenbrenner, 1975). If and how a student learns is a function of a two-level system:

1. Characteristics of the learner and the learner's environment
2. Relationship between and within those environments (Bronfenbrenner, 1976).

For example, how academically prepared for college a student is may be highly related to the school attended, or how well a school can prepare students may be related to the socio-economic status of the family or community.

This study primarily addresses three systems of the theory and the interactions between them (see Figure 3). First are the individual characteristics such as age, gender, and ethnicity. The microsystem is represented by the secondary school environment with characteristics such as racial make-up, average years of teacher experience, and average academic performance. The mesosystem is represented by the secondary school letter grade assigned by the state. The interactions between the systems include the high school academic performance of the student and the cross-level interaction potential of the student performance and secondary school average

academic performance. The exo-system and macro-system are not directly represented or measured; however, the macro-system is represented by the culture of the student. The chronosystem is a measure of time and its effect, which, if measured in this study would represent high school graduation or other major events a student may have experienced.

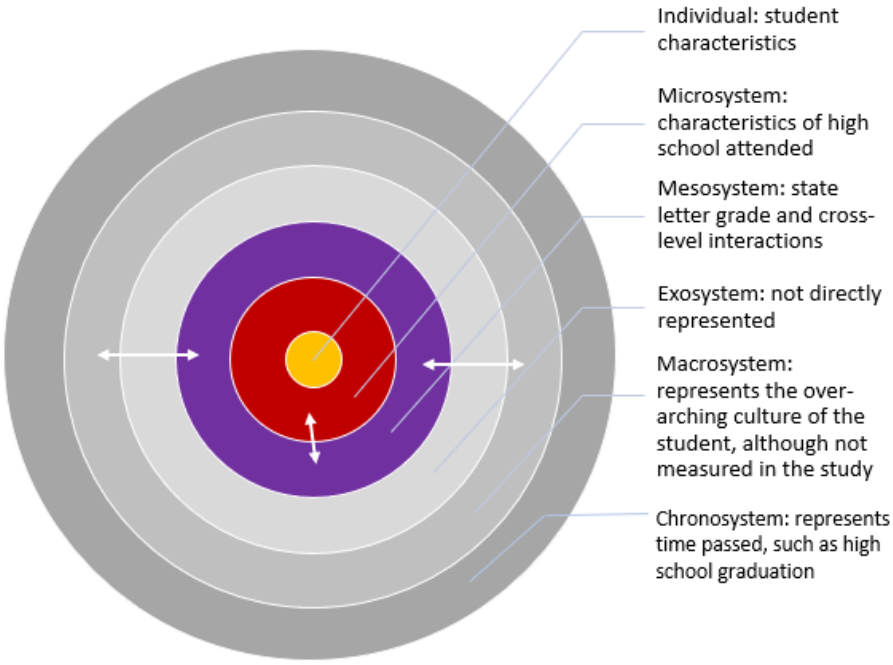

Figure 3. This figure illustrates the layers of the Ecological Theory of Development used for this study and how each layer is addressed, if it is.

Bronfenbrenner (1976) discusses investigating the ecology of education and the importance of studying the varying systems between the learner and the environment. Applying Bronfenbrenner's framework to this study, one would make note that community colleges are unique, not only in their characteristics, but within the individuals and systems of the schools and communities served. These systems aid in the development of students attending the college. If one were to examine varying concepts one at a time, the framework of the theory would not be met (Bronfenbrenner, 1986).

Research Questions and Hypotheses

The following research questions and hypotheses guide this study and are based on the empirical literature and the Ecological Theory of Development, which explains how a variety of nested factors contribute to student success. In this study, I will examine students nested within high schools and the variation and interactions within and between those levels.

Research Question One

This study examines students nested within high schools, so the first question is to determine if there is any variation in the outcome measure based on high school attended.

Q1: Does the likelihood of completing College English I vary across high schools?

H_1: The likelihood of completing College English I does vary across high schools.

Research Question Two

Students entering college bring with them a variety of backgrounds and experiences, level-one variables, which may contribute to the likelihood of success. This study examines variations among student-level characteristics of academic preparedness, race/ethnicity, gender, socio-economic status, and parent education level.

Burns (2010) suggests that academic preparedness could be the number one predictor of college success and not being academically prepared usually means that there are other individual factors that are stacked against the student. The combination of standardized test scores and HS GPA have been determined as the strongest predictors of post-secondary success as measured by persistence, retention, and/or graduation (Hepworth et al., 2018; Kim, 2015; Sackett et al., 2009; Wolniak & Engberg, 2010; Woods, 2016).

Research studies indicate that white students outperform minority students in varying measures of outcomes when looking at only race (Colvin, 2014; Mertes & Hoover, 2014; Pike et

al., 2014; Wolniak & Engberg, 2010), females outperform males in college success measures (Anderton, 2017; Clotfelter et al., 2013; Fletcher & Tienda, 2009; Li & Dockery, 2015; Mertes & Hoover, 2014; Wolniak & Engberg, 2010; Woods, 2016), and as the parent's education level increases, the likelihood of student achievement increases (Fletcher & Tienda, 2009; Wintre et al., 2011; Wolniak & Engberg, 2010; Woods, 2016). Results have been mixed regarding student socio-economic status (SES), but the majority of studies reviewed found a moderate to strong relationship that students from lower SES have lower academic performance (Black et al., 2015; Clotfelter et al., 2013; Cyrenne & Chan, 2012; Fike & Fike, 2008; Fleming et al., 2018; Pike et al., 2014; Wolniak & Engberg, 2010; Woods, 2016).

Q2: Do established student level predictors of college success influence the likelihood of completing College English I in a rural Arkansas community college?

H_2: Established student level predictors affect the likelihood of completing College English I in a rural Arkansas community college.

Research Question Three

Research indicates that high school attended is one of the strongest predictors of college success, even after controlling for student-level characteristics (Kuh et al., 2006; Lowman & Elliott, 2010; Pike et al., 2014). Based on research reviewed and to not identify specific high schools, this study will look for variations among school-level characteristics of average years of teacher experience, average school academic performance, school SES, and racial make-up.

Q3: Do established school-level predictors of college success explain the school-level variability in the likelihood of completing College English I in a rural Arkansas community college?

H_3: Established school-level predictors explain the school-level variability in the likelihood of completing College English I in a rural Arkansas community college.

Research Question Four

Woods (2016) suggests that secondary schools are responsible for college preparation, or lack thereof. It has been suggested that institutions should not only review individual test scores but also where a student's score ranks within the secondary school attended (Kostal et al., 2017). For this reason, I will examine the interaction between the ACT reading and English composite at the student level with the average ACT reading and English composite at the high school level. To determine whether this interaction exists, I must first examine whether the relationship between a student's composite ACT score and College English I completion varies across high schools. Accordingly, I ask the following question:

Q4: Does the relationship between a student's composite ACT reading and English score and her or his likelihood of completing College English I vary across high schools?

H_4: The relationship between a student's composite ACT reading and English score and her or his likelihood of completing College English I does vary across high schools.

Research Question Five

If this relationship is found to vary across high schools, the subsequent question examines a potential school level variable that may help explain this variation. This is known as a cross-level interaction. Accordingly, I ask the following question:

Q5: Does a high school's average composite ACT reading and English score influence the relationship between a student's composite ACT score and his or her likelihood of passing College English I in a rural Arkansas community college?

H_5: The high school's average composite ACT reading and English score influences the relationship between likelihood of completing College English I and the student's composite ACT reading and English scores in a rural Arkansas community college.

Summary

Most research has been completed on large universities and urban community colleges, which affirms the need for further study on small, rural community colleges. Institutions of higher education primarily use standardized test scores for admissions and course placement, although a multiple measure procedure is encouraged. Institutions using high school grades as part of their admissions and placement procedures have higher success rates and lower course misplacement rates than those using standardized exams alone. Institutions may be hesitant to use high school grades, specifically GPA, due to the potential of grade inflation related to inconsistent rigor and grading across secondary schools. Using ACT and other standardized test scores alone to predict success in a college gateway course is not preferred due to factors that influence those scores, such as the high school quality, participation in exam preparatory courses, and secondary academic performance. In order to create an efficient admissions and placement process for the diverse community college student population, administrators must think outside the box. There are many established predictors of college success at both the student and secondary school levels. Serving students and increasing their likelihood of success requires examination of these established predictors to determine the local context and how the predictors interact. It is then that secondary school leaders and community college leaders can come together to design and implement programs and interventions to increase college success.

CHAPTER THREE

Methodology

This study is a quantitative study requiring multi-level modeling with logistic regression. I explain each step required for this study and then present the research question, statistical modeling equation, and substantive and statistical hypotheses. I then discuss the study design and setting. Participant demographic information is provided to show parameters and better explain the study population and setting. The materials section explains where the data comes from. Each variable is then defined operationally for this study. The tests being used for analyses are discussed, including testing for meeting of assumptions. A few threats to the study's validity are discussed, although some are discussed in more detail in Chapter Five as limitations. Finally, I summarize major points to close the chapter.

Research Questions and Hypotheses

This study is driven by five research questions which include established level-one (student) and level-two (high school) predictors of college success. How a student learns is a function of the interaction between the individual characteristics and the environment (Bronfenbrenner, 1976). Although many potential interactions were found in the literature review, this study focuses on one. With such importance placed upon standardized exam scores for college admissions and course placement the interaction examined is focused on ACT scores. Tables 3-7 explain each step of the modeling.

The first step is to determine if variation exists in the outcome measure across high schools. An empty random-intercept model is needed to determine if there is significant variation across level-two units. If no variation is present, multi-level analysis is not required.

Table 3
Model One

Question	Does the likelihood of completing College English I vary across high schools?
Model	$\eta_{ij} = log\left(\frac{\pi}{1-\pi}\right) = \beta_{0j}$ $\beta_{0j} = \gamma_{00} + u_{0j}$ $\eta_{ij} = log\left(\frac{\pi}{1-\pi}\right) = \gamma_{00} + u_{0j}$
Substantive hypothesis	The likelihood of completing College English I does vary across high schools.
Null hypothesis	*H_0: $u_{0j} = 0$* *$NOTE$: u_{0j} refers to the variability in high school intercepts.*
Alternative hypothesis	*H_A: $u_{0j} > 0$*

Assuming variance exists at the school level, the second step is to run a random-intercept model including level-one variables. This identifies whether the likelihood of completing College English I is affected by student-level characteristics, defined by high school grade point average (HS GPA), composite ACT score using only reading and English scores, race/ethnicity (white, black, Hispanic, other), gender, socio-economic status (SES), and parent education level.

Table 4
Model Two

Question	Do established student-level predictors of college success influence the likelihood of completing College English I in a rural Arkansas community college?
Model	$\eta_{ij} = log\left(\frac{\pi}{1-\pi}\right) = \gamma_{00} + \beta_1 HSGPA_{ij} + \beta_2 ACT_{ij} + \beta_3 black_{ij} + \beta_4 hispanic_{ij} + \beta_5 other_{ij} + \beta_6 female_{ij} + \beta_7 SES_{ij} + \beta_8 edu_{ij} + u_{0j}$ $\beta_{1j} = \gamma_{10}$ $\beta_{2j} = \gamma_{20}$ $\beta_{3j} = \gamma_{30}$ $\beta_{4j} = \gamma_{40}$ $\beta_{5j} = \gamma_{50}$ $\beta_{6j} = \gamma_{60}$ $\beta_{7j} = \gamma_{70}$ $\beta_{8j} = \gamma_{80}$ $\eta_{ij} = log\left(\frac{\pi}{1-\pi}\right) = \gamma_{00} + \gamma_{10} HSGPA_{ij} + \gamma_{20} ACT_{ij} + \gamma_{30} black_{ij} + \gamma_{40} hispanic_{ij} + \gamma_{50} other_{ij} + \gamma_{60} female_{ij} + \gamma_{70} SES_{ij} + \gamma_{80} edu_{ij} + u_{0j}$
Substantive hypothesis	Established student-level predictors affect the likelihood of completing College English I in a rural Arkansas community college.
Null hypothesis	H_0: $\gamma_{10} = \gamma_{20} = \gamma_{30} = \gamma_{40} = \gamma_{50} = \gamma_{60} = \gamma_{70} = \gamma_{80} = 0$
Alternative hypothesis	H_A: $\gamma_{10} \neq 0, \gamma_{20} \neq 0, \gamma_{30} \neq 0, \gamma_{40} \neq 0, \gamma_{50} \neq 0, \gamma_{60} \neq 0, \gamma_{70} \neq 0, or\ \gamma_{80} \neq 0$

The third step is to run a random-intercept model adding level-two variables, which for this study includes average years of teaching experience, average school ACT reading and English composite, school SES, racial make-up, and performance grade assigned by the state.

Table 5
Model Three

Question	Do established school-level predictors of college success explain the school-level variability in the likelihood of completing College English I in a rural Arkansas community college?
Model	$\eta_{ij} = log\left(\frac{\pi}{1-\pi}\right) = \gamma_{00} + \gamma_{01}teachexp_j + \gamma_{02}avgACT_j + \gamma_{03}schoolSES_j + \gamma_{04}makeup_j + \gamma_{05}grade_j + \gamma_{10}HSGPA_{ij} + \gamma_{20}ACT_{ij} + \gamma_{30}black_{ij} + \gamma_{40}hispanic_{ij} + \gamma_{50}other_{ij} + \gamma_{60}female_{ij} + \gamma_{70}SES_{ij} + \gamma_{80}edu_{ij} + u_{0j}$
Substantive hypothesis	Established school-level predictors explain the school-level variability in the likelihood of completing College English I in a rural Arkansas community college.
Null hypothesis	H_0: $\gamma_{01} = \gamma_{02} = \gamma_{03} = \gamma_{04} = \gamma_{05} = 0$
Alternative hypothesis	H_A: $\gamma_{01} \neq 0, \gamma_{02} \neq 0, \gamma_{03} \neq 0, \gamma_{04} \neq 0, or\ \gamma_{05} \neq 0$

It has been suggested that institutions should examine how student scores rank within the secondary school attended (Kostal et al., 2017). To look for a possible interaction, step four is to determine if there is variation across high schools regarding the relationship between student average ACT reading and English composite and likelihood of completing College English I. I will run a random-intercept random-slope model with level-one and level-two predictors, allowing the slope for student ACT to vary to determine if the relationship between student ACT composite and College English I completion varies across high schools.

Table 6
Model Four

Question	Does the relationship between a student's composite ACT reading and English score and his or her likelihood of completing College English I vary across high schools?
Model	(Start with altered Model Three with β_{2j}) $\eta_{ij} = log\left(\frac{\pi}{1-\pi}\right) = \gamma_{00} + \gamma_{01}teachexp_j + \gamma_{02}avgACT_j + \gamma_{03}schoolSES_j + \gamma_{04}makeup_j + \gamma_{05}grade_j + \gamma_{10}HSGPA_{ij} + \beta_{2j}ACT_{ij} + \gamma_{30}black_{ij} + \gamma_{40}hispanic_{ij} + \gamma_{50}other_{ij} + \gamma_{60}female_{ij} + \gamma_{70}SES_{ij} + \gamma_{80}edu_{ij} + u_{0j}$ I then plug a substitution into the above (model three). $\beta_{2j} = \gamma_{20}ACT_{ij} + u_{2j}$ $\eta_{ij} = log\left(\frac{\pi}{1-\pi}\right) = \gamma_{00} + \gamma_{01}teachexp_j + \gamma_{02}avgACT_j + \gamma_{03}schoolSES_j + \gamma_{04}makeup_j + \gamma_{05}grade_j + \gamma_{10}HSGPA_{ij} + \gamma_{20}ACT_{ij} + \gamma_{30}black_{ij} + \gamma_{40}hispanic_{ij} + \gamma_{50}other_{ij} + \gamma_{60}female_{ij} + \gamma_{70}SES_{ij} + \gamma_{80}edu_{ij} + u_{2j}ACT_{ij} + u_{0j}$
Substantive hypothesis	The relationship between a student's composite ACT reading and English score and her or his likelihood of completing College English I does vary across high schools.
Null hypothesis	H_0: $u_{2j} = 0$
Alternative hypothesis	H_A: $u_{2j} > 0$

Assuming the slope varies across high schools, the final question addresses how its underlying relationship is moderated by a school-level characteristic.

Table 7
Model Five

Question	Does a high school's average composite ACT reading and English score influence the relationship between a student's composite ACT score and his or her likelihood of passing English 1?
Model	$\eta_{ij} = log\left(\frac{\pi}{1-\pi}\right) = \gamma_{00} + \gamma_{01}teachexp_j + \gamma_{02}avgACT_j + \gamma_{03}schoolSES_j + \gamma_{04}makeup_j + \gamma_{05}grade_j + HSGPA_{ij} + \gamma_{20}ACT_{ij} + \gamma_{30}black_{ij} + \gamma_{40}hispanic_{ij} + \gamma_{50}other_{ij} + \gamma_{60}female_{ij} + \gamma_{70}SES_{ij} + \gamma_{80}edu_{ij} + \gamma_{22}avgACT_j * ACT_{ij} + u_{2j}ACT_{ij} + u_{0j}$
Substantive hypothesis	The high school's average composite ACT reading and English score influences the relationship between likelihood of completing College English I and the student's composite ACT reading and English scores.
Null hypothesis	H_0: $\gamma_{22} = 0$
Alternative hypothesis	H_A: $\gamma_{22} > 0$

Methods

Study Design

This study takes a quantitative, two-staged nested, between-subjects approach. It implements a cross-level examination of established college success predictors and how they may influence the likelihood of completing College English I at a rural Arkansas community college. With predictors at both levels, student and high school, and the possible interaction, this study will be centered on Bronfenbrenner's Ecological Theory of Development. This theory explains student learning as a function of a two-level system:

1. Characteristics of the learner and the learner's environment

2. Relationship between and within those environments (Bronfenbrenner, 1976).

The design assumes there is variation across high schools and students. This study accesses existing datasets for both variable levels. The student data was collected during the 2017-18 and 2018-19 academic years and includes only first-time entering students to control for prior college education. Two academic years were chosen to allow for an ample population after removing students who have missing data and to provide current and relevant results.

Study Setting

The study includes students at a rural community college in central Arkansas, the University of Arkansas Community College at Morrilton. UACCM was established in 1963 and became part of the University of Arkansas System in 2001. The college has an average enrollment of slightly under 2,000 with 60% of students majoring in general education and 40% in career technical studies (UACCM, 2019). Courses are offered at the freshman and sophomore levels in technical, occupational, and academic programs. Degrees awarded include Certificates of Proficiency, Technical Certificates, and Associate Degrees. The location of the college is in a town with a population of 7,065 and surrounded by two large public and two private four-year universities within 30-miles either direction (UACCM, 2019).

The community college student population demographics are shown in table 8. These students primarily attended high schools within a six-county service area of the college. Table 9 shows where in the service area students attended high school.

Table 8

Demographics of UACCM students

	2017-18	**2018-19**
Total students	1921	1902
Female	62%	63%
Male	38%	37%
Full-time	62%	54%
Part-time	38%	46%
White	75.5%	74.7%
Black	8.2%	7.7%
Hispanic	6.7%	7.9%
Other	9.6%	9.7%

Note. The data are adapted from the community college's student management system. Retrieved from www.uaccm.edu.

Table 9
Counties of high schools

	2017	2018
Conway	17.6%	19.6%
Faulkner	42.8%	42.3%
Perry	6.1%	5.0%
Pope	16.9%	15.2%
Van Buren	4.0%	4.9%
Yell	4.6%	6.0%
Other	7.9%	6.9%

Note. The data are adapted from the community college's student management system. Retrieved from www.uaccm.edu.

Materials

Data for this study is provided by the Office of Institutional Research at the UACCM. Student-level data is collected from admission applications submitted by first-time entering students and from financial aid records. First-time entering students have matriculated into the system and have not earned any college credits at enrollment. Students are removed if data for ACT scores, HS GPA, or parent education level is missing. Students from out of state are also removed as high school data on those students would not be accessible and may be measured differently than in Arkansas. Students who attended private high schools or were homeschooled are removed for secondary education missing data. The data for College English I completion is collected from college records recorded in the student information system through the Office of the Registrar.

College English I was chosen for this study due to its overall low success rate of 58.9% (UACCM, 2019) at the college being studied. This course is required for most students in post-secondary education regardless of attending a two- or four-year institution; therefore, the importance of reviewing predictors of College English I success is a driving force in identifying it as the outcome measure. Students who withdrew themselves (W) or were administratively withdrawn (AW) are included in this study and considered non-completers.

School-level characteristics are collected based on the Arkansas Department of Education (ADE) School Report Card data. This public data is required by each school district in the state. Data from 2016-17 and 2017-18 academic years is used for the secondary school dataset to ensure students in the college dataset were students at the high school during the time the data points were collected.

Measures

College English I Completion, Dependent Variable

Course completion is defined as earning an A, B, or C (ADHE, 2018; Colvin, 2014). For purposes of this study, course completion is earning an A, B, or C in College English I. An A, B, and C will be coded as1; D, F, W, and AW will be coded as 0.

Level One Variables

Level one variables are student characteristics that are established predictors of college success.

ACT Score, Independent Variable. The ACT test is designed to measure the level of knowledge students master in high school in preparation for college (ACT, 2018). Colvin (2014) defined ACT as a standardized admissions test using a score as a measure of knowledge and readiness which colleges use for course placement. For this study, the ACT score is a calculation of the average of the student's ACT reading and English scores. The guidelines used by ACT (2019) to calculate the composite is to average the subtest scores, then round down for below. 50 and up for .50 or above (ACT, 2019). The average used in the study does not round up in order to avoid rounding error possibilities. All scores are a .50 or .00 score.

HS GPA, Independent Variable. HS GPA is recorded as official GPA at graduation. This data is collected from official high school transcripts required for college admission and is a continuous variable.

Race, Independent Variable. For this study, race is defined by self-reported data collected at the time of college admittance. This will be coded as White=0; Black=1; Hispanic=2; Other=3. White will serve as the reference category.

Gender, Independent Variable. Gender is determined by self-reported data at the time of college admittance and has two levels, male and female. It is dummy coded with Male=0 as the reference group.

Socio-Economic Status (SES), Independent Variable. SES is defined as whether a student received federal Pell funds or not. This is collected through the financial aid office and is recorded as part of student data. Students receiving Pell funds are coded=0; No Pell=1.

Parent Education Level, Independent Variable. The definition of parent education level is from the college's admissions application, which asks if either parent has a college degree or certificate. This most closely follows the definition from Woods (2016). This is self-reported data. There are two categories, yes or no. Coding is Yes=0; No=1.

Level Two Variables

Level two variables are high school characteristics that are established predictors of college success. In order to meet power analysis, two years of data has been collected. Each school may only have one listed measure for each variable. Therefore, each of the level two variables are calculated as the average of the 2016-17 and 2017-18 data points.

Average Years Teaching Experience, Independent Variable. Average years teaching experience is used as the measure of high school quality. This is the average number of years

teaching experience of faculty at the secondary institution. A two-year average is used for this study. This is a continuous variable.

Average ACT Score, Independent Variable. The average ACT score is the average score for all secondary students within the data year for high school seniors taking the exam. For purposes of this study, a composite score will be created using only the average reading and English scores. This will be a two-year average and is not rounded.

School Socio-Economic Status (SES), Independent Variable. School SES is based on the percentage of low-income students attending the high school and represents a two-year average. This is a continuous variable.

Racial/Ethnic Make-Up, Independent Variable. This is defined by the reported racial make-up of the secondary school attended calculated as percentage of white population and represents a two-year average. It is a continuous variable.

School Letter Grade, Independent Variable. The ADE publicizes a school performance report card for each district and school. One aspect of the report is a school rating reported as a letter grade. The rating is calculated using achievement, growth, graduation rate, English learner progress, and school quality/student success indicators (ADE, 2017). The score is reported as an A, B, C, D, or F. The rating is aligned with the Every Student Succeeds Act, which supports federal accountability (ADE, 2017). The variable is transformed into a numerical measure like GPA, where A=4, B=3, C=2, D=1, and C=0. A two-year average is then calculated and used in this study.

Data Collection

Student-level data is obtained from the UACCM's Department of Institutional Research. The data is an existing dataset collected as part of the student file either at time of college

admission or from the Office of the Registrar and the Office of Financial Aid. The data includes first-time entering students enrolled in College English I during the 2017-18 and 2018-19 academic years that graduated from an Arkansas pubic school in 2017 or 2018. In order to meet requirements of FERPA, all student identifiers (including but not limited to social security number, student identification number, and date of birth) were removed by the college prior to submission to the study. Data from the Arkansas Department of Education is used for secondary school-level characteristics. The secondary school public data is for academic years 2016-17 and 2017-18 ensuring the high school data includes the years the college students were attending the school. Each school-level measure is a two-year average.

Participants and Placement

A power analysis was conducted using a 1.5 odds ratio, alpha=.05, Beta=.80, and an expected small correlation with other X (R^2=.10). The resulting output was a required sample size of 231. A second power analysis was run with the same inputs other than R^2. This second time, I entered a medium expected correlation, R^2=.30. The resulting required sample size was 296. I ran two power analyses because there are many variables involved and nested data structures. To ensure proper sample size, I chose 296 as the minimum.

Data received included 484 students. Five students were removed who did not report race/ethnicity leaving a sample size of 479. Students in the dataset graduated in 2017 or 2018 from an Arkansas public high school and were enrolled in College English I during the 2017-18 and 2018-19 academic years. First-time entering students are chosen to control for prior college education. Race/ethnicity was reported with six categories. The data was recoded to result in only three categories: black, Hispanic, and other. White students served as the reference group.

The grade variable was recoded into completed (A, B, or C) and not complete (D, F, W, and AW).

Demographics of students within the dataset are in Table 10. These students primarily attended high schools within a six-county service area of the college. There were 35 high schools represented in the data.

Table 10

Demographics of participants

Total students	479
Female	54.3%
Male	45.7%
White	75.4%
Black	7.5%
Hispanic	10%
Other	7.1%

Note. The data are pulled from the community college's student management system.

Data Analysis

Multi-level modeling with logistic regression is used to test each hypothesis. As required by logistic regression, the outcome measurement is a dichotomous variable of completed College English I or did not complete. This study assumes the natural log of the odds used by running a logistic regression analysis is the appropriate logit link function, and, therefore, the relationship between the predictors and the logit of the outcome variable will be linear. Predictors are checked for multi-collinearity. The Statistical Package for the Social Sciences (SPSS) software, version 26 is used to run the analyses. Frequencies and distributions are included in the data analysis interpretation.

Ethical Considerations

There are no ethical risks to this study as it is a non-experimental study using existing data. College data has all student identifiers removed prior to submission for the study. High school data used is considered public data, and specific schools are not identified as the study is

reviewing characteristics rather than specific schools. The UACCM Director of Institutional Research removed the high school identifier from the public data and connected it to each student accordingly to ensure consistency in the data and that a data point cannot be linked back to a student or high school.

Internal and External Validity

Because this study is non-experimental and uses existing datasets, internal validity is threatened by selection bias. Selection bias is a potential threat because most non-traditionally aged students do not take the ACT exam. The standardized exam used for admissions and placement when no valid ACT score is available has not been stable. As this study was being developed, the alternative exam changed multiple times, and the newest version was just being implemented; therefore, those students without a valid ACT score are excluded from the study. Limiting the data to students who graduated from an Arkansas public high school in 2017 and 2018 limits the age of the students studied.

Some confounding variables, such as student dropout, motivation/drive, hours worked, hours studying, etc. cannot be accounted for in this study. Although the above stated factors may serve as threats, it is important to include all students from the cohort, even those who withdrew or were administratively withdrawn from College English I, because the results could reveal critical information regarding the population. These threats are discussed in more detail in Chapter Five as limitations of the study.

Threats to external validity are the characteristics of the participants and secondary schools and the ability to generalize to other populations. To control for this, I examine characteristics of the secondary school setting, or environment, rather than specific secondary schools. Colleges from other areas may have secondary schools which share these general

characteristics and may use the results as a baseline for reviewing their own students' success levels. This study's results are not meant to be generalized beyond future students of the college in the study or, at best, small, rural Arkansas community colleges with similar demographics of students and secondary schools.

Summary

I have explained the details of the study by reviewing research questions and hypotheses. The study is a quantitative two-staged nested study using multi-level modeling with logistic regression. The study is of students from one small, rural Arkansas community college, UACCM, with fewer than 2,000 students who are from secondary schools with varying characteristics. Estimated participant demographic information was provided to reveal parameters and better explain the intended population of the study. Definitions for all variables and an explanation of how the data will be collected and analyzed was provided. Due to using existing datasets, there are no ethical concerns with this study.

The intent of this study is to review established student-level and secondary school-level characteristics that may impact completion of College English I at a rural community college in central Arkansas, UACCM. This study will provide critical information regarding the local student population which can be used by the community college and secondary schools to provide opportunities and interventions to increase student success in college. The study considers secondary school characteristics rather than identifying specific institutions, allowing this study to provide valuable information which may be generalizable to other rural higher education institutions, but only as a baseline. The information gathered during this study is key in the move toward productivity-based funding where accountability becomes paramount. Post-secondary institutions cannot increase credentials, progression, and transfer success rates without

students completing foundational gateway courses. It is critical that community colleges focus their energy and resources where they can make the greatest impact and that they work with secondary schools to ensure students are successful in college. This study examines both student and school characteristics to provide information allowing for more efficient and targeted interventions to be designed and implemented.

CHAPTER FOUR

Results

The purpose of this study was to review student-level and secondary school-level characteristics that may explain College English I completion at a rural community college in central Arkansas, the University of Arkansas Community College at Morrilton (UACCM). This chapter explains the preparation of the dataset, testing of assumptions, data analyses, and results for each research question. The dataset received from the University of Arkansas Community College at Morrilton required some cleaning of data due to small cluster sizes, including some with only one student. Due to its nature, the study required only one test for assumptions, linearity of the logit. The data analyses section discusses the modeling process and addresses each research question specifically.

Data Sample

Data from the University of Arkansas Community College at Morrilton included 484 students from 35 school districts. Heck et al. (2012) discusses that missing data can cause problems in multi-level modeling; based on this information, I removed five students who did not report race/ethnicity, leaving a sample size of 479. Schunck (2016) suggests that clustering size of fewer than ten observations leads to an average bias of 93%, meaning it is highly likely that variation will be over- or under-estimated when small cluster sizes are present. Based on this finding and convergence issues of model one, I removed all schools with ten or fewer students. This left 13 schools made up of 409 individuals, see Table 11 for cluster size by school. I discuss further details of data cleaning and convergence issues in the data analyses section.

Table 11

Cluster sizes for secondary schools

School ID Number	Cluster Size	Percent of N
1	16	3.9
5	15	3.7
11	20	4.9
12	136	33.3
13	11	2.7
14	12	2.9
15	16	3.9
16	48	11.7
21	21	5.1
22	47	11.5
26	27	6.6
27	13	3.2
28	27	6.6
Total	**409**	**100.0**

The Arkansas Department of Higher Education's (ADHE) 2019 Comprehensive Report includes data for all sectors and levels of post-secondary education combined as well as secondary school college-going rates. According to the ADHE Report, Arkansas had a 47.1% college-going rate in Fall 2018; 16% of high school graduates attended two-year universities (ADHE, 2019b). Of the 160,615 students enrolled at any Arkansas post-secondary institution at any level, undergraduate students comprised 75.8%. Of those undergraduate students, 1.6% (1902 students) attended UACCM (ADHE, 2019b). Of all students attending college at any level in Arkansas in Fall 2018, 58.7% were female and 41.2% were males (ADHE, 2019a). These results parallel the undergraduate students in the dataset, 54.3% and 45.7% respectively. The race/ethnic breakdown of Arkansas college students enrolled at any level in Fall 2018 was 67.4% white students, 15% black students, 6.6% Hispanic students, and 8.5% students reporting other races, or unknown (ADHE, 2019a), which is quite different in comparison to the dataset consisting of only undergraduate students at the one community college studied, see Table 12. No breakdown at the state level could be found regarding the number of college students receiving Pell aid. The College Board (2019) reported that 31% of undergraduate students

nationally received Pell Grant assistance compared to 41.6% at the rural community college in this study. Demographics of the final dataset for the study as compared to national or state where available are presented in Table 12. I could find no state- or national-level data on parent education level for comparison.

Table 12
Final Dataset Compared to State/Nation

Total students	409	160,615 (state)
Female	54.3%	58.7% (state)
Male	45.7%	41.2% (state)
White	79.1%	67.4% (state)
Black	8.1%	15% (state)
Hispanic	11.5%	6.6% (state)
Other	7.1%	8.5% (state)
Received Pell	41.6%	31% (nation)
No Pell	58.4%	69% (nation)
Parent Has Degree	51.1%	Unknown
Parent No Degree	48.9%	Unknown

Test and Assumptions

I used multi-level modeling with logistic regression to test my hypotheses because my outcome was dichotomous and my questions used nested data structures. A binary outcome as the dependent variable means the normal assumptions of homoscedasticity and normality used in ordinary least squares linear (OLS) regression do not apply. The one assumption to test for was linearity of the logit, which assumes all continuous predictors have a linear relationship with the log of the outcome. To test for this, I used the Box-Tidwell Procedure. I computed the natural log of each continuous variable then created an interaction term between it and its natural log. Each continuous variable and its interaction term were then added to the model. Two interaction terms, Student ACT composite, β = .73, S.E. = .27, p = .01, OR = 2.08, and school socio-economic status (SES), β = -.17, S.E. = .08, p = .04, OR = .84, presented as potential violations of linearity of the logit, suggesting each could have a curvilinear relationship to the logit of the outcome. To account for this, a quadratic term for Student ACT composite and school SES were added to

subsequent models. Other continuous variable interaction terms checked and found to not violate this assumption were HSGPA, β = 2.00, S.E. = 2.10, $p > .05$, OR = 7.35; racial make-up β = -.08, S.E. = .14, $p > .05$, OR = .92; school ACT composite β = 11.00, S.E. = 9.37, $p > .05$; OR = 59629.94; and average years teacher experience β = -.47, S.E. = .80, $p > .05$, OR = .62.

Analysis

Using SPSS version 26, I constructed models through the generalized linear mixed models tool. This allowed me to examine individual observations on a categorical outcome while looking for variation across groups. First, I ran an empty random-intercept model to check for variation across level-two units. Upon running this model, I received a warning noting that co-variant measures were not positive definitive and the model could not converge. Heck et al. (2012) recognizes that model convergence can be an issue for multi-level modeling when using a categorical outcome measure due to the requirement of quasi-likelihood estimations or numerical integration that comes with solving complex nonlinear equations. Unsure if the nonconvergence resulted from potential issues brought out by Heck et al. (2012) or small cluster sizes in some school districts, I began an iterative process of removing schools with a low cluster size. I first removed schools with only one student in the cluster, which eliminated 12 schools. I ran the model again and received the same warning. I then removed schools with fewer than five students and ran the model still without convergence. I continued this process, removing any additional schools with cluster sizes of ten or less. Only 13 schools remained from the original 35 represented. I chose more than ten as a cluster size based on Schunck's (2016) study suggesting that level-one cluster sizes of 5 and 10 had a high bias rate. Schunck discusses that the bias rate does not decrease when increasing level-two units, but bias does decrease when level-one cluster sizes increase; however, he notes that even with moderate cluster sizes

available, the potential of considerable bias still exists. Ringdal (n.d.) suggests variance is underestimated when small numbers of groups are used, which potentially downwardly biases, or underestimates, the results. Therefore, I stopped decreasing my dataset, even though the model would not converge, as to not decrease my sample size and increase potential bias more than necessary. I was not able to get a model to converge; however, when I ran subsequent models with level-one variables and required quadratic terms, I was able to obtain a converged empty model. Using the statistics from the best fit model, the empty model showed little to no variation across high schools, β = .09, S.E. = .13, Z = .72, p > .05, 95% CI (.00, 1.39)

Next, I added level-one variables, HS GPA, student composite ACT score using only reading and English scores, race/ethnicity, gender, socio-economic status measured by Pell award (SES), and parent education level, as fixed-effects to the model to examine whether student-level characteristics explained the likelihood of completing College English I. I also added the quadratic terms for student ACT and school SES since these were found to possibly violate the assumption of linearity of the logit. The school SES quadratic term was found to be non-significant, β = -5.78E-5, S.E. = 3.51E-5, t = -1.65, p > .05, 95% CI (.00, 1.12E.5), OR 1.00; therefore, the predictor does not violate the assumption of linearity of logit. Since no violation existed, I removed the quadratic term for school SES. The student ACT quadratic was significant, β = .02, S.E. = .01, t = 3.20, p = .001, 95% CI (.01, .03), OR 1.02. This confirmed student ACT does violate the assumption of linearity of the logit, meaning student ACT has a nonlinear relationship with the outcome. After removing the school SES quadratic term, I ran the model again with only original level-one predictors and the quadratic term for student ACT. High school GPA, β = 1.94, S.E. = .23, t = 8.42, p < .001, 95% CI (1.49, 2.39), OR 6.96, and student ACT, β = -.73, S.E. = .22, t = -3.39, p = .001, 95% CI (-1.15, -.31), OR .48, were found

to have significant influence on the probability of College English I completion. These findings will be discussed in further detail in the results section. All other level one predictors were found to have no significant influence: female, β = -.11, S.E. = .22, t = -.52, p > .05, 95% CI (-.54, .31), OR .893; student SES, β = .02, S.E. = .20, t = .08, p > .05, 95% CI (-.37, .40), OR 1.02; parent education level, β = .06, S.E. = .40, t = .15, p > .05, 95% CI (-.72, .84), OR 1.06; race/ethnicity - black, β = -.37, S.E. = .19, t = -1.90, p > .05, 95% CI (-.74, .01), OR .69; race/ethnicity – Hispanic, β = .08, S.E. = .33, t = .22, p > .05, 95% CI (-.581, .730), OR 1.08; race/ethnicity – other, non-white, β = -.53, S.E. = .30, t = -1.80, p > .05, 95% CI (-1.12, .05), OR .59.

Since model one revealed no variation between high schools, β = .09, S.E. = .13, Z = .72, p > *.05*, 95% CI (.00, 1.39), I did not need to continue with the developed models examining level-two variables. However, since I was initially interested in an interaction, I created a random-slope model to examine if the relationship between a student's ACT composite score and likelihood of completing College English I varied across high schools. The model did not converge; therefore, minimal or no variation exists in student ACT composite across high schools, β = .00, S.E. = .00, Z = .90, p > .05, 95% CI (.00, .00). I did not need further examination of a cross-level interaction as planned.

Results

Findings, or explanation of no findings, for each question are presented below. Table 13 presents complete model results.

Does the Likelihood of Completing College English I Vary Across High Schools?

Model one did not converge, suggesting minimal or no variation exists in College English I completion across high schools. I confirmed this when I ran model two and found a non-significant measure of the random intercept listed in the output, β = .09, S.E. = .13, Z = .72, p >

.05, 95% CI (.00, 1.39). These findings suggest no reason to continue with multi-level modeling or further examination of level-two independent variables.

Do Established Student-Level Predictors of College Success Influence the Likelihood of Completing College English I in a Rural Arkansas Community College?

Out of six level-one variables, only two were found to have significance in explaining the probability of College English I completion. High School GPA was found to be the most influential, β = 1.94, S.E. = .23, t = 8.42, $p < .001$, 95% CI (1.49, 2.39), OR 6.96. For every one-point increase in HSGPA, a student is nearly 7 times (~700%) more likely to complete College English I than not to complete. More applicably, for every 0.1 increase in HSGPA, a student is 0.696 times (69.6%) more likely to complete College English I than to not complete. Student ACT was also found to be significant to the probability of College English I completion, β =-.73, S.E. = .22, t = -3.39, p = .001, 95% CI (-1.15, -.31), OR .48. With the quadratic term being significant in the best fit model, β = .02, S.E. = .01, t = 3.29, p = .001, 95% CI (.01, .03), OR 1.02, I needed to further explore the potential relationship between student ACT and the predicted probability of completing College English I to determine if there was a curvilinear relationship. To do this I hand-calculated the model holding all variables constant except for student ACT score and its quadratic term. I did this for all even ACT datapoints between ten and 30. I then graphed the relationship (see Figure 4). The predicted probability of completing College English I decreased as the ACT increased until the score 20. At that point the predicted probability leveled off until around a score of 22 where a slight increase began in probability of completion and probability became stronger with each two-point increase in student ACT score.

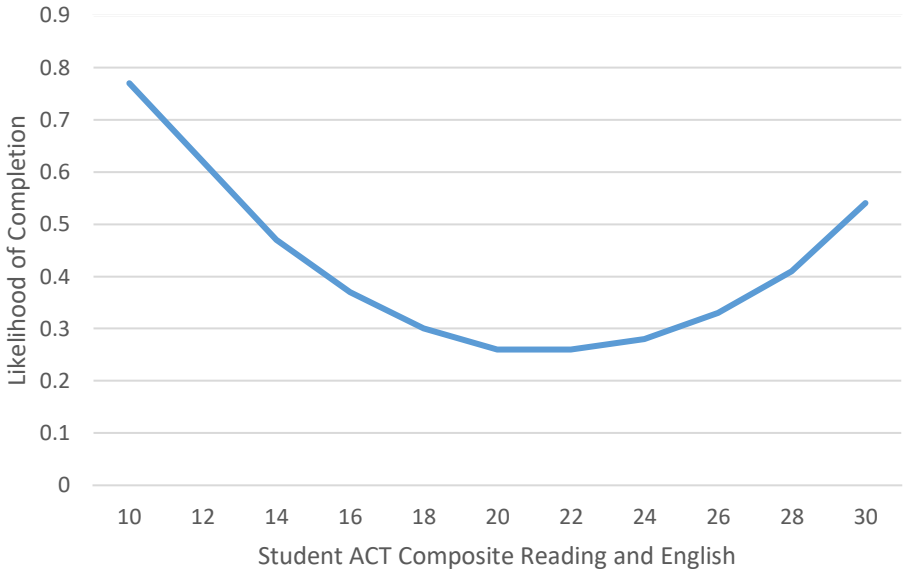

Figure 4. Graph shows the curvilinear relationship between Student ACT Composite and the likelihood of College English I completion.

Do Established School-Level Predictors of College Success Explain the School-Level Variability in the Likelihood of Completing College English I in a Rural Arkansas Community College?

I did not run a model examining school-level characteristics because no variation between high schools emerged in model one.

Does the Relationship Between a Student's Composite ACT Reading and English Score and Her or His Likelihood of Completing College English I Vary Across High Schools?

This model did not converge; therefore, minimal to no variation in the relationship between student ACT composite and College English I completion was found across high schools. Although the model did not converge, test statistics were displayed in the output supporting the lack of variance in student ACT across high schools, β = .00, S.E. = .00, Z = .90, p > .05, 95% CI (.00, .00).

Does a High School's Average Composite ACT Reading and English Score Influence the Relationship Between a Student's Composite ACT Score and His or Her Likelihood of Passing College English I in a Rural Arkansas Community College?

I found no variation across high schools nor in the student ACT composite specifically; therefore, I did not need to run the final planned model testing for an interaction between student ACT and school ACT average.

Validity and Reliability

Unexpectedly, threats to external validity arose due to nearly one-third of the schools having only one student in the cluster. This could not be avoided based on the study's variables and the need to remove those data points for model convergence. Additionally, schools with cluster sizes of ten or smaller also required removal based on Schunck's 2016 suggestion. The removal of these schools brought the level-two sample of schools from 35 to only 13. Ringdal (n.d.) suggested that variance is underestimated when using small numbers of groups, which means the results of this study are potentially downwardly biased or underestimated. Another unexpected concern is that the study has an unbalanced design in that cluster sizes range from 11 to 136. This also could not be avoided because the study focused on one community college. The Mixed Generalized Linear Modeling allows for this, but it still needs to be recognized as a potential threat to external validity.

Summary

During data clean-up, I removed two-thirds of schools for low cluster size; this left 13 schools in the final dataset and a sample size of 409 students. The first model determined minimal to no variance existed across high school. This meant multi-level modeling was not required; therefore, I did not run all the developed models with level-two predictors. I added a

quadratic term for student ACT composite and school SES to the second model of data analysis due to a potential violation of the linearity of logit assumption. No violation was found regarding school SES, so I removed the quadratic term and ran the model a second time. The model included the student ACT composite quadratic term due to the assumption violation and existing nonlinear relationship with the outcome. For the predictors in this study, I found HSGPA to provide the best explanation of likelihood of College English I completion and student ACT to have a nonlinear relationship with the outcome. These findings support the literature reviewed for this study.

Table 13

Multi-level Modeling for College English I Completion

	Model 1			Model 2 (1st run)			Model 2 (2nd run)			Model 3		
Covariate	*b* (SE)	*t*	Odds ratio	*b* (SE)	*t*	Odds ratio	*b* (SE)	*t*	Odds ratio	*b* (SE)	*t*	Odds ratio
Intercept	1.034 (.0824)	12.543	2.812	3.217 (2.6910)	1.195	24.942	2.813 (2.4929)	1.128	16.662	2.789 (2.4837)	1.123	16.271
HSGPA	--	--	--	1.955 (.2156)	9.068	7.065	1.941 (.2304)	8.424***	6.963	1.947 (.2321)	8.388***	7.004
Student ACT	--	--	--	-.747 (.2272)	-3.288	.474	-.730 (.2155)	-3.387***	.482	-.731 (.2145)	-3.406***	.482
Female	--	--	--	-.104 (.2238)	-.463	.902	-.113 (.2168)	-.520	.893	-.114 (.2163)	-.526	.892
Black	--	--	--	-.381 (.1858)	-2.051	.683	-.365 (.1926)	-1.896	.694	-.376 (.1933)	-1.946	.687
Hispanic	--	--	--	.050 (.3248)	.155	1.052	.075 (.3335)	.224	1.078	.070 (.3341)	.209	1.072
Other, non-white	--	--	--	-.519 (.3006)	-1.727	.595	-.534 (.2961)	-1.804	.586	-.540 (.2954)	-1.828	.583
SES	--	--	--	-.016 (.1956)	-.084	.984	.015 (.1958)	.076	1.015	.014 (.1961)	.069	1.014
Parent Ed Level	--	--	--	.054 (.3901)	.138	1.055	.060 (.3961)	.151	1.062	.064 (.3965)	.160	1.066
Student ACT Quad	--	--	--	.018 (.0055)	3.199***	1.018	.017(.0053)	3.289***	1.017	.017 (.0052)	3.306***	1.017
School SES Quad	--	--	--	-5.778E-5 (3.5090E-5)	1.647	1.000	--	--	--	--	--	--
Variance Component	Est. (SE)	Z		Est. (SE)	Z		Est. (SE)	Z		Est. (SE)	Z	
Var. (intercept)	Model did not converge			.093 (.128)	.724		.108 (.120)	.898		.085 (.108)	.786	
Student ACT										Model did not converge .000 (.000)	.900	
Model Criteria												
AIC	1836.205			1969.265			1947.629			1950.286		
D AIC				133.06			-21.636			2.657		
BIC	1840.206			1973.241			1951.608			1958.234		
D BIC				133.035			-21.633			6.626		
-2LL	1834.195			1967.255			1945.619			1946.256		
D -2LL				133.06			-21.636			0.637		

Note. Ref = Reference, AIC = Akaike Information Criterion (lower is better fit), BIC = Bayesian Information Criterion, -2LL = -2 Log Likelihood
*p<.05, **p<.01, *p≤.001

CHAPTER FIVE

Overview

In this chapter, I summarize the study, including its purpose, problem statement, methodology and key findings from the literature. I also discuss the guiding questions, findings, and conclusions drawn from the study. Several limitations in this study may affect the interpretation and generalizability of the results, which I will also address. Last, I make recommendations for practices in higher education and future studies.

Summary

The purpose of this study was to review student-level and secondary school-level characteristics that may explain College English I completion at a rural community college in central Arkansas, the University of Arkansas Community College at Morrilton (UACCM). Each community college is unique in its student population and communities served. For this reason, I examined how student-level and secondary school-level characteristics influence the likelihood of community college gateway course completion, specifically College English I. This course is required by all students completing a technical certificate, associate's degree, or bachelor's degree in Arkansas higher education institutions and is commonly taken the first semester or, at minimum, freshman year.

The following research questions guided the study:

1. Does the likelihood of completing College English I vary across high schools?
2. Do established student-level predictors of college success influence the likelihood of completing College English I in a rural Arkansas community college?

3. Do established school-level predictors of college success explain the school-level variability in the likelihood of completing College English I in a rural Arkansas community college?
4. Does the relationship between a student's composite ACT reading and English score and his or her likelihood of completing College English I vary across high schools?
5. Does a high school's average composite ACT reading and English score predict the relationship between a student's composite ACT score and his or her likelihood of passing College English I?

The study helped fill a gap in the literature by reviewing combined demographics of students and secondary schools within rural central Arkansas rather than focusing on large mid-western or urban institutions. Li and Dockery (2015) suggest students from rural schools perform worse than their counterparts, and that little is known about how secondary school-level characteristics are associated with rural students' performance. Based on research from mostly urban institutions, researchers suggest that high school quality affects nearly every aspect of college success, even when controlling for such student characteristics as individual academic achievement (Fletcher & Tienda, 2009, 2010; Kuh et al., 2006; Pike et al., 2014).

This study provides important information to the University of Arkansas Community College at Morrilton regarding the local student population and the likelihood of success in College English I. Like most institutions of higher education, UACCM primarily uses standardized test scores for admissions, scholarships, and course placement even though a multiple measures approach is encouraged. Institutions using high school grades as part of their

admissions and placement procedures have higher success rates and lower course misplacement rates than those using standardized exams alone (Colvin, 2014).

A common theme throughout the literature reviewed is the significance of past academic performance as measured by high school grade point average (HS GPA) and standardized exam scores. Barkley and Frost (2004) and Ngo and Kwon (2015) examined specific course grades rather than cumulative HS GPA. This view may be more accepted by community college administrators because grades from courses directly related to gateway courses may be a more valid predictor of student success than HS GPAs that are potentially inflated from low-rigor courses. Although UACCM solely uses standardized exam scores for course placement, standardized writing and reading exam scores are not suggested as predictive of English completion (Belfield & Crosta, 2012; Jenkins et al., 2009, Ngo et al., 2018). However, the American College Test (ACT) used by Arkansas higher education institutions has found that benchmark scores, commonly used for course placement, predict a 50% chance of earning a B and a 75% chance of earning a C (ACT, 2018). Studies that failed to find these scores predictive of course completion may have overlooked ACT exam scores, used placement scores outside of determined benchmarks, or failed to consider factors that may impact results. Regardless of other predictors, high school quality (or high school attended) likely plays a significant role in multiple measures of college success throughout one's college career (Arcidiacono & Koedel, 2014; Black et al., 2015; Colvin, 2014; Cyrenne & Chan, 2012; Fletcher & Tienda, 2009, 2010; Kuh et al., 2006; Li & Dockery, 2015; Pike et al., 2014; Wolniak & Engberg, 2010).

Hein and Smerdon (2013) argue colleges should not look at indicators or predictors individually but as part of a whole, and Bronfenbrenner (1976) suggests how a student learns is a function of the interaction between the personal characteristics and those of their environment.

Accordingly, Bronfenbrenner's Ecological Theory of Development served as a foundation of this study's design, and I examined individual characteristics (student level predictors) and environmental characteristics (school level predictors). For this study, I adopted a quantitative, two-staged nested, between-subjects design using multi-level modeling with logistic regression.

Conclusions

I examined student-level and secondary school-level characteristics from a limited student population at the University of Arkansas Community College at Morrilton, located in a rural area of Arkansas. The results of my study failed to support four of my five alternative hypotheses. Those not supported are:

- The likelihood of completing College English I does vary across high schools.
- Established school-level predictors explain the school-level variability in the likelihood of completing College English I in a rural Arkansas community college.
- The relationship between a student's composite ACT reading and English score and her or his likelihood of completing College English I does vary across high schools.
- The high school's average composite ACT reading and English score influences the relationship between likelihood of completing College English I and the student's composite ACT reading and English score.

My first conclusion from this study is that high school characteristics may not be a reliable predictor of college-level course success in rural communities. No differences in success rate between high schools were found. This could have been because UACCM students primarily come from rural high schools with similar characteristics. As such, the findings of this study may not generalize to community colleges that serve both urban and rural high schools. This is not to

say that high schools are academically preparing students well enough for college success; rather, I was unable to identify differences between high schools.

After finding no differences in success between high schools, I turned my focus on student-level predictors. My findings partially support the alternative hypothesis that established student-level predictors affect the likelihood of completing College English I. From this I draw my second conclusion. Student HS GPAs and ACT scores may best predict success in college English I courses; however, this could be influenced by community college course placement practices. No student characteristics besides HS GPA and student ACT English and reading composite increased the likelihood of success in the course. A student's HS GPA is the best predictor of College English I completion. A one-point increase in HS GPA means a student is 700% more likely to complete College English I than not to complete, or 69.6% more likely to complete than not with a 0.1 increase. Student ACT is the next best predictor of College English I completion, but the predictive relationship is not linear. A student with an ACT score of 10 is more likely to complete the course than a student with an ACT of 20, but a student with an ACT of 20 is less likely to complete than a student with an ACT score of 28. Current practices at UACCM do not consider HS GPA, only ACT scores for English and reading. If a student scores lower than 19 on their English or reading ACT, remedial courses are required. ACT (2020) suggests an 18 English subset score as college-ready for College English I; however, UACCM has set the standard of a 19 English subset score as the benchmark for enrolling in College English I. Although ACT does not have a recommendation for reading subset score related to College English I, UACCM requires a 19 reading subset score. A student must have met both English and reading score benchmarks to be placed in the College English I course. As such,

those with very low ACT scores may benefit from remedial course placement, whereas those with average to low ACT scores do not.

Limitations

These results are limited in their ability to be generalized and should only be used as a baseline by other rural community colleges. The data are limited to a small number of secondary schools with varying cluster sizes. With the limited secondary schools included, the variation across schools may have been underestimated. The study is limited to variables that are quantitatively measured and are accessible within an extant database. This limits the generalizability of findings to students of similar characteristics from similar schools, and it omits potential qualitative variables that are potentially predictive of student success. Findings are also limited by secondary school data access and the length of standardized exam score validation. ACT scores are only valid for five years, and typically only traditionally aged students have valid ACT scores. The data did not include nontraditionally aged students with standardized exam scores older than five years and standardized exam scores other than the ACT. Therefore, these findings will not assist the college with predicting success rates of nontraditional students, which is notable because community colleges serve nontraditional students at similar or greater rates than traditional students.

Discussion

Research indicates that high school attended is one of the strongest predictors of college success, even after controlling for student-level characteristics (Arcidiacono and Koedel, 2014; Kuh et al., 2006; Lowman & Elliott, 2010; Pike et al., 2014). I used secondary school-level characteristics rather than specific school districts to anonymize schools that may be academically under preparing students; however, I found that the high school a student attends

does not influence the likelihood of that student's success in College English I at UACCM. This aligns with Li and Dockery (2015), who suggests school characteristics do not influence the likelihood of college success measured by first-year grades. Most previous studies had large sample sizes and were completed at large, urban, or mid-western, four-year institutions. My study had a relatively smaller sample size (N = 409) and focused on a small, rural community college. Thirteen high schools were included in this study, and no differences were found in their completion rates.

Students come from varying backgrounds and bring their own sets of characteristics with them when attending college. Past research on individual characteristics has been mixed. For this study, there is no difference in the likelihood of success based on student characteristics other than past academic achievement. These findings are in agreement with previous studies suggesting the combination of standardized test scores and HS GPA to be the strongest predictors of post-secondary success as measured by persistence, retention, and/or graduation (Hepworth et al., 2018; Kim, 2015; Sackett et al., 2009; Wolniak & Engberg, 2010; Woods, 2016). Both HS GPA and ACT composite reading and English scores are measures that could be used to predict the likelihood of success in College English I.

High school GPA is most often recognized as the strongest predictor of varying measures of post-secondary success (Anderton 2017; Barkley & Frost, 2004; Belfield & Crosta, 2012; Fletcher & Tienda, 2010; Kim, 2015; Li & Dockery, 2015; Wolniak & Engberg, 2010; Woods, 2016). My study supports those findings with HS GPA being the strongest predictor for College English I completion at UACCM, with a one-point increase in HS GPA leading to a 700% higher likelihood of completing College English I than not completing. Turk (2017) determined that a one-point increase in HS GPA increases the probability of completing a credential by 25.3%. In

Arkansas higher education institutions, College English I is a gateway course that must be successfully completed, or a student cannot earn a credential. Woods (2016) explains the effects of HS GPA further by suggesting a student with a 3.0 or higher GPA has an increased likelihood of success and a student with a 2.0-2.9 may need remediation courses to increase chances of being successful in college courses. I found similar results in that 63% of students with a HS GPA of 2.0-2.9 and 85% of those with a 3.0-3.9 successfully completed the course. With only 63% of students with a HS GPA of 2.0-2.9 successfully completing the course, these students may benefit from remediation.

Currently, HS GPA is not part of course placement at UACCM, only ACT scores; specific to College English I is ACT reading and English subset scores (UACCM, 2018). Using standardized test scores for placement has received mixed reviews. Barkley and Frost (2004) determined ACT to predict varying post-secondary success measures, whereas Jenkins et al. (2009) determined it not to be a significant predictor of college success. My findings reveal a curvilinear relationship between ACT score and completion of College English I. The predicted probability of completing College English I decreased as the ACT increased until the composite score of 20. At that point, the predicted probability leveled off until around a score of 22, where a slight increase is seen in the probability of completion. Probability became stronger with each two-point increase in student ACT score. At UACCM, students must meet the minimum requirements of 19 on both English and reading to enroll in College English I. Students with ACT scores lower than 19 are enrolled in a remediation course to prepare for the college-level course. What is interesting regarding students requiring remediation is the closer the ACT score got to the benchmark of 19, the lower the likelihood of College English I completion. Boatman and Long (2018) also found that students requiring lower levels of remedial work in reading and

writing had higher chances of success in the college-level course than students that were borderline of needing remediation. Students with a lower ACT score having a higher likelihood of College English I completion could be related to the remediation course taken as my study did not examine remediation enrollment.

Recommendations

Based on my findings, I offer several recommendations for a better understanding of UACCM's student population and how to increase its likelihood of success.

Recommendations for Teaching and Practice

UACCM follows ACT recommendations for course placement, which are based on the benchmark of 75% completion rate of a C or better (ACT, 2020; UACCM, 2018). Currently, HS GPA is not considered in course placement. Based on this study, if UACCM were to use the same 75% completion rate benchmark and apply it to HS GPA as part of course placement, students would need a 3.1 or higher HS GPA to be placed in college-level courses with an English and reading prerequisite. Only 68% of students with a 2.5-3.0 HS GPA in my study successfully completed College English I. It took a 3.1 HS GPA to get above the 75% pass rate threshold, meaning students would need at least a 3.1 cumulative HS GPA to be placed in college-level courses.

A multiple measures approach, including HS GPA and ACT score may serve the students and the community college better than either variable alone (Belfield & Crosta, 2012; Colvin, 2014; Kostal et al., 2017; Ngo et al., 2018; Ngo & Kwon, 2015). Hepworth et al. (2018) suggested academic preparedness be measured by a calculated score using HS GPA, ACT score, and need for remediation for prediction of success. Some institutions may have a concern with the rigor of courses students take in high school. According to Goldrick-Rab (2010), students

attending community colleges are less likely to have taken rigorous coursework in high school and 57% of American community colleges rank academic preparedness as fair or poor. If institutions are apprehensive about incorporating cumulative HS GPA into course placement protocol, the approach of Barkley and Frost (2004) and Ngo and Kwon (2015) could be taken, which only considers specific course grades, such as English, math, and science courses. This would minimize the importance of inflated HS GPAs from low rigor courses and may be an important consideration for course placement decisions.

Secondary schools are responsible for preparing students for college-level work (Woods, 2016). This study may serve secondary schools in acknowledging the role of HS GPA and ACT scores in predicting the likelihood of college success, so interventions and programs can be established to better prepare students for college (Black et al., 2015). Barnett and Hughes (2010) discussed a partnership between El Paso Community College, the University of Texas at El Paso, and their local high schools; the institutions joined together to develop an introduction to a college program in which students learn about the colleges, complete the admissions process, take college placement exams, and other college preparatory activities. In developing college preparatory programs, Colvin (2014) warns that focusing primarily on test-taking could lead to inflated test scores as students become better at taking tests, yet not better performing in reading and writing. If high schools work with colleges in developing interventions and courses, then local students could have access to a high school curriculum that aligns more closely with what they will experience at the college level.

Recommendations for Further Study

With the limitations of this study, several areas are recommended for further examination. The study is limited to a small number of students with a restricted age range.

Future studies should include nontraditional students and additional standardized exams other than the ACT. Nontraditional students typically do not have a valid ACT score obtained within five years. ACT is most often taken by high school students making scores only valid for a maximum of five years post-graduation. Nontraditional students do not enter college immediately after high school and are commonly enrolling several years after high school. They may have taken the GED rather than graduating from high school. The standardized exam for students without an ACT score has not been consistent over the years, which makes it difficult to do further research in this area. These exams typically do not have recommended benchmarks leaving it up to the college to determine course placement scores. When adding nontraditional students to the study, time since high school graduation should be considered since HS GPA plays such a significant role in predicting the likelihood of success. It would be important to know if there is a time limit on the impact of HS GPA. Studies involving nontraditional students become more complex when considering how earning a GED influences success and should include researching a reliable GED to HS GPA conversion tool for comparison if planning a multiple measure approach.

As institutions of higher education begin to look for additional ways to ensure student success, multiple measures should be considered for course placement and are recommended by the Arkansas Division of Higher Education (ADHE, 2018). I recommend a future study on multiple measures to examine if interactions exist between HS GPA and ACT scores. According to past research by Hein and Smerdon (2013) and Woods (2016), having at least a 3.0 HS GPA increases the likelihood of post-secondary success, and having a 2.0-2.9 HS GPA may require remediation to be successful in college courses. HS GPA is a known predictor, but there are other factors that may intensify that predictor's influence (Cyrenne & Chan, 2012). There are

blurred lines surrounding ACT score, specifically for students that score around placement cutoffs (Hassel & Giordano, 2015). This may lead to students being placed in a course that is either academically lower or higher than they are prepared for (Hassel & Giordano, 2015). Examining the interaction between HS GPA and ACT score could provide insight into a multiple measures model for course placement.

At the time of my study, UACCM students who score a 19 or lower on the ACT in reading or English are enrolled in remediation courses to prepare for college-level courses. Based on my findings, remediation may have a larger impact on those with lower ACT scores and less on those closer to the benchmarks. In my study, students with an ACT score of 10 had a higher success rate than students with an ACT score of 20. This could be related to the remedial course taken; therefore, future research examining the effects of remediation on college success may be needed. Taking remedial courses has traditionally been associated with students not completing a certificate or degree (Clotfelter et al., 2015); however, current models of remediation use a co-requisite model which shows a higher success rate especially for those at the lowest assessed academic level (Vandal, 2014). Students requiring lower levels of reading and writing remediation have higher rates of success than students deemed borderline for remediation (Boatman & Long, 2018), which is supported by my findings. Fike and Fike (2008) also determined that students who completed a remedial reading course were more likely to be retained than those who did not complete the course. However, Clotfelter et al. (2015) found no adverse effects on the retention of students but did find a reduced probability that students taking remedial reading or writing courses will ever complete the college-level English course. More research is needed to determine the success of remedial courses in relation to college success measures.

Other outcome measures such as graduation and retention rates could also be used to examine the influence of student-level and school-level characteristics on student success. The study only examined one gateway course. Gateway courses are strongly connected to degree completion (Bloemer et al., 2017), and further studies should include additional gateway courses such as freshman-level math and social science courses which are part of requirements for all associate's and bachelor's degrees in Arkansas. For the results to be most efficiently used, the community college, and other colleges using these findings as a baseline, should develop and implement further studies to examine additional factors that may influence college success in rural areas.

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