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Predictive Ability of Multiple Factors on Secondary Students' ACT Scores at a Large Suburban High School

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PREDICTIVE ABILITY OF MULTIPLE FACTORS ON SECONDARY STUDENTS'
ACT SCORES AT A LARGE SUBURBAN HIGH SCHOOL

A Dissertation Submitted
to the Graduate College
Arkansas Tech University

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of the College of Education

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Abstract

As college-bound high school seniors know, the ACT examination is possibly the single most important assessment students take during their academic careers. ACT scores can determine college entrance, scholarship dollars, and whether students will be placed in remedial courses. Parents pay large sums of money to prepare their children for this exam, and states use the scores as a metric to quantify the quality of schools and districts. Since 2015, all high school students in Arkansas take the ACT in the spring of their junior year. Given the significance of this exam, students, parents, and school personnel would benefit from knowing what factors could potentially predict ACT scores. This study measured the predictability of several factors on ACT subject area and Composite scores. The researcher used Multivariate General Linear Hypotheses to measure the predictability of gender, socio-economic status, eighth grade ACT Aspire scores (including Readiness scores), and the number of Pre-AP and AP courses taken on ACT subject area and Composite scores. The data indicated that the students' eighth grade ACT Aspire Composite score contributed most significantly to ACT score predictability. After the Aspire Composite scores, the number of Pre-AP and AP courses taken was the second greatest contributor to predictability.

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CHAPTER 1: INTRODUCTION

Background of the Study

Beginning in the 2015-2016 school year, Arkansas public schools began administering the ACT examination and ACT Aspire summative assessment as the official state tests (Worsham, 2018). Every student in Arkansas takes the ACT Aspire in grades three through ten and the ACT examination in the spring of his or her junior year (Pritchett, 2018). The ACT is an examination accepted by most colleges and universities across the United States as an important data point in consideration for enrollment (Pritchett, 2018).

First administered in 1929, the ACT began as a test for Iowa high school students, but grew throughout the years into a national test to measure students' academic strengths and weaknesses (Lindsay, 2015). In 1959, over 75,000 students took the four-section exam (Lindsay, 2015). A student's score on the ACT could determine that student's acceptance into college. With the importance of ACT scores, students, school staff, and parents need to know how to prepare students properly for the exam.

Shortly after the Aspire and ACT were implemented in Arkansas, Bentonville Public Schools (BPS) implemented an initiative to enroll more students into Pre-Advanced and Advanced Placement classes. The district was hoping to increase the number of students in more rigorous coursework to better prepare them for college and the workforce (Hunt, 2018).

BPS employed Equal Opportunity Schools (EOS) to assist with the effort. EOS is a company headquartered in Seattle, Washington, that partners with schools to increase their Advanced Placement enrollment. EOS assists schools in specifically targeting

minority and low-income populations within schools to increase their AP enrollment to the same level as non-minority and non-low-income students (Equal Opportunity Schools, 2019). According to its website, EOS's stated purpose is to "collaborate with school districts to increase equitable enrollment in Advanced Placement (AP) and International Baccalaureate (IB) classes, so more students can excel" (Equal Opportunity Schools, 2019, "Equal Opportunity Schools brings," para. 1).

The students at Bentonville West High School (BWHS), whose data were used for this study, were encouraged to register for one or more AP classes. Students completed surveys to collect the following information: (a) academic strengths and weaknesses, (b) barriers to their choosing to take AP classes, and (c) adults they trust within the school. Survey data disaggregated by EOS was used to identify the most effective strategy to encourage students and/or their parents to enroll the students in one or more AP courses. In addition, BWHS students were encouraged to take Pre-Advanced Placement (Pre-AP) courses to help prepare them for AP classes (Bentonville Schools, 2018).

Preparation for the ACT is important (Wignall, 2019). College acceptance and scholarship funds depend on a good score, usually a composite of 19 or higher (Arkansas Tech, 2019; University of Arkansas, n. d.). All Arkansas high school students are required to take the ACT in their junior year (Pritchett, 2018).

This encouragement is accomplished by staff members initiating conversations with students and their parents about AP courses and recommending the students enroll in them. The benefits of AP courses are well documented, with the most popular being the opportunity for a student to earn college credit in high school, build an impressive

college application, prepare for the increased rigor in college-level courses, and receive weighted high school credit for the courses (Bentonville Schools, 2018; College Board, 2019).

Statement of the Problem

Because ACT scores are an integral part of the college admission process and scholarship selection, more research is needed to understand the relationship between students' eighth grade ACT Aspire scores, gender, socio-economic status, enrollment in Pre-AP and AP courses and their ACT scores. Investigation is needed to identify and quantify the level of the predictability between the predictor variables and the ACT scores.

Purpose of the Study

The purpose of this correlational study was to explore the relationships between students' ACT Aspire scores, gender, socio-economic status, enrollment in Pre-AP and AP courses and their ACT scores. The predictor (independent) variables in this study were the number of Pre-AP and AP courses students chose to take in their ninth, tenth, and eleventh grade years of high school as well as their eighth grade ACT Aspire scores, gender, and socio-economic status. The criterion (dependent) variables were the ACT subject area scores in Math, English, Reading, and Science, and the ACT Composite scores.

The ACT examination is divided into four subject area tests, each with a respective sub score: English, Reading, Mathematics, and Science (The ACT test for students, 2019). The ACT offers an optional writing section which was not used for this study. Because these scores are important to each student's academic future, finding the

relationship between the number of Pre-AP and AP courses a student chooses to take and correlating these numbers of courses with ACT scores could prove valuable to schools and students, as the advanced subject area classes should be preparing students to succeed on the ACT.

Research Questions and Hypotheses

The research questions guiding this study were:

1. RQ1: What is the relationship between gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, the number of Pre-AP and AP courses taken by grade 11, and secondary students' ACT scores?
2. RQ2: For low-achieving students, what is the relationship between gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, the number of Pre-AP and AP courses taken by grade 11, and secondary students' ACT scores?
3. RQ3: For students who qualify for free or reduced lunch, what is the relationship between gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, the number of Pre-AP and AP courses taken by grade 11, and secondary students' ACT scores?
4. RQ4: What is the relationship between the number of Pre-AP and AP courses taken by grade 11 and secondary students' ACT scores?

The (null) hypotheses of this study were the following:

1. H_{01} : The following variables do not predict ACT subject area and composite scores: gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, and the number of Pre-AP and AP courses completed by grade 11.

2. H_{02} : The following variables do not predict ACT subject area and composite scores for low-achieving students: gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, and the number of Pre-AP and AP courses completed by grade 11.
3. H_{03} : The following variables do not predict ACT subject area and composite scores for students who qualify for free or reduced lunch: gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, and the number of Pre-AP and AP courses completed by grade 11.
4. H_{04} : The number of Pre-AP and AP courses completed by grade 11 does not predict ACT subject area and composite scores.

The sample used for this study was approximately 320 members of the BWHS graduating class of 2019. The number of students exceeds the minimum of 116 needed for a statistically significant sample (Green, 1991).

Definition of Terms

The following terms were used throughout the study:

- ACT Examination: A standardized test given across the United States primarily to high school students for the purpose of college admission and placement. The ACT is comprised of four parts, English, math, reading and science (Princeton Review, 2019).
- ACT Subject Area Scores: The ACT examination is divided into four subject areas: Math, English, Reading, and Science. Each subject area score will fall between 1 and 36 (endpoints included) and comprise one quarter of the ACT Composite score, which is the mean of the subject area scores (ACT, Inc., 2019).

- Advanced Placement (AP) Courses: High school courses certified by the College Board, which include an assessment at the end of the course that could result in college credit being awarded to the student.
- AP College Board Examination: The assessment given at the end of every AP course. Colleges use the test grades, ranging from one to five, to determine if college credit will be granted for the course.
- ESEA: The Elementary and Secondary Education Act, enacted by President Johnson in 1975, allocated millions of federal dollars to educating disadvantaged students (Klein, 2015).
- ESSA: The Every Student Succeeds Act, passed in 2015, was the Obama administration's replacement for No Child Left Behind (Wodiska, 2018).
- MGLH: A Multivariate General Linear Hypothesis regression model analyzes data with multiple independent variables (covariates) and identifies which variables are potentially useful in predicting the dependent variable(s).
- Pre-Advanced Placement (Pre-AP) Courses: Advanced courses designed to transition students into AP courses later in their high school careers.
- Weighted Credit: An additional grade point average point is added to a student's grade following the completion of an AP course and the corresponding exam. For example, a B in a non-AP course usually carries a weight of three. A grade of B in an AP course will earn the student a four to be averaged into his or her overall GPA.

Assumptions

The researcher accepts several assumptions to be true for the purposes of this study.

- ACT Aspire and ACT examination scores are deemed to be valid and reliable.
- The students' Aspire readiness scores from eighth grade are assumed to be accurate and reflect the students' aptitude for academic success in high school.
- The student records were collected from Triand, the database used by all schools in Arkansas. All records are assumed to be accurate.
- The students gave a reasonable effort on the ACT Aspire assessment and ACT examination to achieve at the highest level possible on their exam.
- All the AP classes at BWHS are designed to be more rigorous and the teachers attempt to push the students to higher levels of cognition and academic achievement.

Limitations

The most significant limitation of the study was the number of students and the relatively small geographic area from which the sample was gleaned. With all the subjects coming from one class at one school, the generalizability of the data could legitimately be questioned. The subjects represented a convenient sample from a specific school; therefore, the findings from this study cannot be generalized to any other population of students.

Additional classes could have supplemented the pool of subjects. Including one more year would have doubled the number of available students in the study, giving twice as much data to draw from. However, due to the constraints of this study, such an

option was not feasible. Subjects and data from other schools around the state and nation could add additional transferability to the study as well.

Delimitations

The delimitations of this study started with the subjects whose data was being considered. The Bentonville West graduating class of 2019 was comprised of 408 students. Of that number, 312 completed the eighth grade ACT Aspire and/or the ACT examination. Students who did not take either of these assessments were excluded from the study. The geographic area was limited to the students at one school.

Gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, and the number of Pre-AP and AP courses taken by grade 11 served as the independent (predictor) variables for this study. The ACT Composite and subject area scores, served as the dependent (criterion) variables for this study. Several more variables from within the same study could have been added from the same data source. For example, variables such as attendance rates and ELL classification could have been included to make the study richer. Course grades were not being considered in this study, nor are the scores the students earned on the AP examinations. Also, this study did not measure other factors that could affect a student's ACT score. Some examples of potential factors not measured include participation in ACT review programs, the number of times a student took the ACT exam, differing instructional strategies between teachers and classes, and level of parents' education.

Significance of the Study

Although several independent variables were being examined, a focus area for this study was the potential use of the numbers of Pre-AP and AP courses students chose

to take as a predictor for ACT scores. This study was completed to add to the body of information available on the predictors of ACT success for Arkansas high school students and the need to determine the legitimacy of selecting more rigorous courses as a predictor for the ACT scores. Researchers have conducted similar studies in other states. Miron (2008) used data from a suburban school in New Jersey to determine the effect of relaxing AP entrance criteria and placing more students into AP classes on the AP exam scores. His data indicated that including more students in the AP courses did not significantly affect the AP exam scores (Miron, 2008). In a larger study, Colgren (2014) used data from the Illinois Department of Education to attempt to quantify the effect of taking AP courses on students' ACT scores. Colgren concluded that, in general, taking AP courses resulted in increased ACT scores (Colgren, 2014).

The results of the Bentonville West study could be used to help parents and students determine the importance of students electing to enroll in Pre-AP and AP courses. Should the study results show a positive correlation, the school staff could cite the correlation when working with students and parents to determine which classes the students should select. If the study results demonstrated a relationship that was minimal or non-existent, the staff could focus preparation efforts on a different initiative to prepare students for the ACT examination in their junior year. For example, the school staff could review ACT preparation programs and put their resources into one that data indicated could be effective for their students.

CHAPTER 2: REVIEW OF THE LITERATURE

For many years, schools have required students to complete required standardized examinations (Alcocer, 2019). Students are expected to give their best effort on their examinations, and schools are expected to adequately prepare students to achieve at the highest level possible. Multiple studies concluded that teachers feel excessively pressured for their students to perform well on high-stakes testing, with some teachers even listing this pressure as a reason for leaving the profession (Labat, Labat, Lee, & Thibodeaux, 2015; Minarechová, 2012).

Throughout the accountability push in the United States, high-stakes testing remains a constant in teacher, school, district, and state evaluations. The ACT Aspire and ACT examination serve in the high-stakes role for the state of Arkansas. Additional importance of a good ACT score is levied by colleges and universities, most of whom use the ACT results for admissions and scholarship purposes (Pritchett, 2018).

Conceptual Framework

The theory that informed this study is “Structural Functionalism,” more commonly referred to as merely “Functionalism” (Vanderstraeten, 2003). Functionalism in education refers to the theory that society prepares students to fill a future role, and schools act as a sorting mechanism for students into those roles (Pai & Adler, 2001). By grouping students into pre-determined tracks, schools can efficiently prepare them for the roles they will inevitably fill (Edwards, 2006). Efficiency is a key characteristic of Functionalism (Edwards, 2006).

A purely Functionalist society would be highly structured, ranking and grouping citizens into their roles (Edwards, 2006). Each person in such a society would clearly

recognize and understand his or her purpose (Edwards, 2006). Given the intense focus on structure, a Functionalist social community would be very orderly (Vanderstraeten, 2003). Some sociologists argue that in this community structure is over-emphasized and disproportional (Vanderstraeten, 2003).

Edwards (2006) contends that Functionalism forms the basis for all standardized testing. Edwards goes on to state that standardized test scores can be used to effectively place students where society can best use them (Edwards, 2006). The United States military and higher education institutions, where students can be further prepared for their specific societal roles, use the standardized test scores to predict which individuals would be successful in their systems (Edwards, 2006). Therefore, if a student wished to achieve a score on the ACT that would place him/her into a good college, the factors that predict that score would be important to know.

In summary, the primary uses of the ACT Examination are college acceptance and scholarships. The ACT scores act as a sorting mechanism, placing students into schools that are the best fit for their academic acumen. The schools then place graduates into the workforce based on their success in school. Structural Functionalism informs this study by reinforcing the importance of ACT success to place a student into his or her desired college and eventually into his or her desired occupation.

History of the SAT and ACT

As early as the mid-1800s, Horace Mann and Samuel Gridley Howe used Prussian-based standardized tests to assess Boston school children (ProCon.org, 2018). Prior to the Civil War, many schools in the United States were using some type of examination to place students in schools (Alcocer, 2019). These exams were often oral

and differed considerably from school to school (Alcocer, 2019). Led by Harvard University, the College Entrance Examination Board, a title later shortened to “College Board,” was founded in 1900 (Atkinson & Geiser, 2009). This board proposed common, standardized examinations that would allow students to take a single assessment to apply to numerous colleges across the United States (Alcocer, 2019).

In 1901, the first common college entrance examinations were administered in nine subjects to 973 students, most of whom were vying for entry into colleges located in New York State (Alcocer, 2019; Young, 2003). Opposition to standardized testing began only a few years later (ProCon.org, 2018). The Kansas Silent Reading Test, an early multiple-choice examination, was first administered in 1914 (ProCon.org, 2018). Multiple choice examinations were created to expedite the scoring and recording of examination scores (Alcocer, 2019; ProCon.org, 2018).

The SAT

In the mid 1920’s, the College Board began administering the Scholastic Aptitude Test, a name later changed to the Scholastic Assessment Test or SAT (Alcocer, 2019). The SAT focused on measuring a student’s cognitive reasoning abilities, prompting students to complete analogies, for example (Lindsay, 2015). Consistent with the college admission focus, SAT scores were originally reported to the colleges or universities of the students’ choosing, not to the students themselves (Young, 2003). Influenced considerably by military intelligence tests, the initial SAT was given in 1926 to over 8,000 students (Young, 2003). For many years, the SAT was accepted and even required for entrance by several private institutions. In 1956, the University System of Georgia was the first public college system to require the SAT for admissions (Young, 2003).

The ACT

In an effort to compete with the SAT, Iowa professor Everett Franklin Lindquist created the American College Test, or ACT, in 1929 as a test for Iowa high school students (Lindsay, 2015). The ACT, as opposed to the SAT, attempted to measure a student's academic strengths and weaknesses so that the student could be appropriately placed in college classes (Lindsay, 2015). The first large-scale administration of the ACT occurred in 1959, when over 75,000 students took the four-section test (Lindsay, 2015). The original ACT sections - English, mathematics, social studies, and natural sciences - were given in 45-minute increments (Lindsay, 2015). Eventually the social studies and natural sciences sections were replaced by reading and science reasoning, respectively, and an optional writing section was added (Lindsay, 2015). By 2015, the ACT surpassed the SAT in the number of administered tests in the United States (Lindsay, 2015).

One component of the ACT exam that the SAT does not offer is the college readiness benchmark report (Allen & Radunzel, 2017). ACT, Inc. set minimum benchmark scores in each of the four test areas as predictors of which students would need remediation in college. Those scores are as follows: English – 18, Mathematics – 22, Reading – 22, Science – 23 (ACT, Inc., 2017; Allen & Radunzel, 2017). Only 11% of Arkansas students and 21% of students across the United States achieved the benchmark scores in all four areas (ACT, Inc., 2017). According to ACT, Inc. (2017), students who achieve these minimum scores have a 75% probability of scoring at least a C in the corresponding college classes and a 50% probability of scoring at least a B in those classes.

Colleges and universities nationwide use students' ACT scores as a key admissions component. For example, the University of Arkansas' admissions webpage states that students need a minimum ACT Composite score of 20 for unconditional admittance, while Arkansas Tech University requires a minimum composite score of 19 to be admitted without remedial courses (Arkansas Tech, 2019; University of Arkansas, n.d.).

Educational Accountability

Educational accountability has existed as long as schools have existed. Ravitch describes accountability as, "holding not only students but also teachers, principals, schools, and even school districts accountable for student performance" (Ravitch, 2002, p. 9). Schools in the 1800's required students to pass a tests or series of tests before being promoted to the next grade. These tests, which differed from state to state, school to school, and even teacher to teacher, held students responsible for their knowledge (Ravitch, 2002). Teachers, however, were required to pass only their initial licensing assessment, and they were certified for the rest of their lives. Their employment process often involved an interview with the school board and the local clergy to determine if the teacher held educational or religious beliefs contrary to community norms (Ravitch, 2002).

Outside of the United States, accountability was shifting to the teachers and schoolmasters centuries ago. Madaus and Stufflebeam (1989) cited a case in 1400's Italy where a schoolmaster was paid based on the achievement of his students. England used a similar model throughout the 1800's where teachers' salaries were, in part, related to student test scores. These early attempts at merit pay were based on the idea that

educators would generate better results if their livelihood depended on student success (Madaus & Stufflebeam, 1989).

The United States saw early accountability efforts in the Boston Grammar Schools by Samuel Gridley and Horace Mann, who implemented city-wide essay exams nearly 200 years ago to replace the oral examinations given prior. Some historians contend that Gridley and Mann developed and required the exams as a ruse to replace the headmasters who did not agree with their policies (ProCon.org, 2018). Today, state education departments and the federal Department of Education continue to use standardized test scores to measure the quality of teaching.

Prior to 1900, most colleges accepted all applicants except for a few elite schools who required their students to take a school-specific entrance examination. The College Board changed college entry practices in the early 1900's by creating a common college entrance exam. The Board went on to create the SAT examination in the 1920's (Atkinson & Geiser, 2009). In 1965, President Lyndon Johnson signed the Elementary and Secondary Education Act (ESEA). This Act is widely believed to be the beginning of organized national accountability for schools in the United States (Brenchley, 2015). The Johnson administration designed the bill to ensure that all students had the opportunity to learn by assisting the most vulnerable students. ESEA was part of Johnson's war on poverty, and established the precedent of using norm-referenced assessments to evaluate schools, districts, and states (Alcocer, 2019; Brenchley, 2015). Use of norm-referenced assessments, such as the ACT examination, for evaluation of public school systems continues today.

A Nation at Risk

During his first term, President Ronald Reagan commissioned the National Commission on Excellence in Education to study and report on the rigor found in America's public schools (Kamanetz, 2018). Their report was entitled *A Nation at Risk: The Imperative for Educational Reform* (United States, 1983). The White House suspected American students were falling behind their international counterparts, and that American public schools were simply not getting the job done when it came to preparing students to compete in an increasingly global economic arena (Kamanetz, 2018).

The report compared U.S. students' standardized test scores with scores from a number of other countries. The report was publicized by Reagan personally when he accompanied the authors in a series of meetings around the country (Kamanetz, 2018). Although many legislators, educators, and parents were alarmed and concerned about the report's findings, others believed the report was taken out of context and that the U.S. public education system was faring better than *A Nation at Risk* had portrayed it (Kamanetz, 2017). According to the Washington Post's Valerie Strauss (2018), recommendations for improvement in the report included more rigorous state standards, higher high school graduation requirements, and required state tests to measure achievement. At the heart of all of the comparisons was the goal for U.S. students to score higher on standardized tests. Nearly four decades after *A Nation at Risk*, the accountability the report advocated remains a part of every public school system in the United States (Strauss, 2018).

No Child Left Behind and Every Student Succeeds Acts

The No Child Left Behind Act of 2001 (NCLB) was ratified by congress and signed into law by President Bush as a reauthorization of the Elementary and Secondary

Education Act (ESEA) in January of 2002 (Klein, 2015). As previously noted, the ESEA, originally enacted by the Johnson administration in 1965, authorized over a billion dollars of federal money to be spent annually on educating disadvantaged students (Klein, 2015).

Bush's NCLB brought a new era of accountability to public education, requiring all students to achieve proficiency benchmarks on their respective state assessments by 2014. Although the proficiency was federally mandated, each state chose what test to use and what minimum score was deemed proficient (Klein, 2015). Schools failing to make "adequate yearly progress" (AYP) toward 100% proficiency faced increasingly intensive sanctions, which could include a reallocation of Title I funding dollars into targeted tutoring programs (Klein 2015). As the 2014 deadline loomed and the required percentage of proficient students neared 100, many states applied for and received waivers from the Department of Education that provided relief from the increasingly stricter standardized test score requirements and resulting sanctions (Klein 2015).

The Obama administration reauthorized ESEA through the Every Student Succeeds Act (ESSA) in 2015. ESSA, which replaced Bush's No Child Left Behind, required states to test students yearly in grades one through eight and once in high school and set proficiency standards for the test results (Lee, 2019). ESSA eliminated the NCLB AYP requirement and granted states additional autonomy to monitor schools' assessment performance as well as levy their own sanctions for falling short of the state's achievement goals (Wodiska, 2018). Under ESSA, each state must submit a plan to the U.S. Department of Education that includes many items such as their plan for testing and

accountability as well as their plan for reporting the testing results to the public (Lee, 2019).

Arkansas complies with ESSA by releasing a letter grade annually for every public school in the state. The letter grade is computed using testing achievement, testing improvement, attendance, graduation rate, and other factors (Ferren, 2014). The letter grade is based on the calculated number score, which can fall from zero up to and including 100. Schools whose test scores do not reach the minimum score for a certain sub-population are placed on Targeted Support status while schools whose overall population does not reach the minimum score are placed on Comprehensive Support status (Ferren, 2014).

ACT Performance and Gender and Socio-Economic Status

The Arkansas ACT score reports for 2017, 2018, and 2019 showed that female students consistently outperformed their male counterparts on almost every area the ACT measures (ACT, Inc., 2017; ACT, Inc., 2018; ACT, Inc., 2019). In the composite scores, female students maintained a 0.4 advantage for 2017, 2018, and 2019, while the biggest subject area difference occurred in English where the females were a full point ahead of the male students on average (ACT, Inc., 2017; ACT, Inc., 2018; ACT, Inc., 2019). Of the three years studied, mathematics was the only area where males outperformed females. Arkansas males averaged an 18.6 in math compared to an 18.4 for females, while in all other areas females outperformed males (ACT, Inc., 2017; ACT, Inc., 2018; ACT, Inc., 2019).

According to Semuels (2017), this trend is emulated nationwide. She states that schooling is often more important to girls than it is to boys; therefore, girls tend to

outperform their male counterparts in high school (Semuels, 2017). Females' relative success in college mirrors their success in high school. According to the National Center for Educational Statistics, females' six year graduation rate stands at 63%, while only 57% of males graduate in the same time period (Fast Facts, 2019).

ACT performance differs significantly according to socio-economic status. Mattern, Radunzel, and Harmston (2016) state that students from households earning less than \$80,000 performed at a lower rate on the ACT examination than their counterparts from households earning greater than \$80,000. Mattern et al. state that the gap in ACT scores between students from low and high earning families remains intact and has, in fact, increased to a full four-point difference by 2016 (Mattern, Radunzel, & Harmston, 2016). This gap is growing because the students' scores from higher earning households are improving marginally while the students' scores from lower earning households are decreasing slightly. Therefore, the authors contend, efforts should be extended to help low-earning families prepare their students for school so that they are ready to achieve at a higher level (Mattern, et al., 2016). For the purposes of this study, socio-economic status was defined by whether students qualified for free or reduced lunch in school. The sample population from Bentonville West High School had a reported free/reduced lunch percentage of 28% (Hunt, 2018).

Advanced Placement Courses

Advanced Placement courses are classes designed for students to take during their high school years. These courses, as the name would suggest, are more rigorous than normal courses, with college credit waiting at the end of a successfully completed course if the student scores high enough on the Advanced Placement examination (College

Board, 2019). Earning college credit while still in high school can save students tuition once they enroll in college. In addition to college credit, students complete Advanced Placement, or AP, courses in order to earn a weighted grade to calculate into their grade point average (GPA). A weighted course credit will earn the student one point higher per class grade thus allowing the student to potentially improve his or her GPA over a non-weighted credit course (College Board, 2019). Finally, AP courses can help prepare students for the increased rigor of college courses, thus alleviating some of the difficulty in transitioning from high school to college (Lindsay, 2018).

As of June of 2019, College Board offered 38 AP courses in seven subject areas, although the number of courses varies from high school to high school (College Board, 2019). AP courses must be taught by AP-certified teachers. The AP certification process involves three to five days of training over the normal teacher licensing process (College Board, 2019). At Bentonville West High School, students were offered 25 AP courses (Bentonville Schools, 2018).

General Effects of Taking Advanced Placement Courses

The related literature on the effects of students completing AP courses is consistent. Connifey-Marlin (2016) determined that students who took AP courses scored higher on the ACT than their counterparts who did not take the advanced classes. In Connifey-Marlin's study, she collected data from 397 eleventh grade students at a large high school in Tennessee. She divided the students' data into three groups based on the number of AP courses the students took their 11th grade year (Connifey-Marlin, 2016). She then used an ANCOVA and a MANCOVA to conclude that the students who were enrolled in at least one AP course their eleventh grade year, the same year they took the

ACT examination, scored higher on average than their counterparts who took no AP courses that year (Connifey-Marlin, 2016).

Warne, Larsen, Anderson, and Odasso (2015) looked at data from the Utah State Office of Education. They took data from two cohorts of Utah students, both with populations over 40,000, to attempt to determine the effects taking the AP courses had on the ACT scores (Warne et al., 2015). The researchers employed an ANOVA to conclude that merely enrolling in an AP course did not affect students' ACT scores, but completing AP courses and taking the AP exams did correlate with higher scores (Warne et al., 2015). Furthermore, completing the AP courses and the AP exams were beneficial to students' ACT scores even after the student data were controlled for a number of factors including academic variables (Warne et al., 2015). The positive correlation continued through each subject area test (Warne et al., 2015). While these studies list the benefits of taking the more rigorous courses, some researchers warn of the negative effects of students taking AP courses.

In a follow-up article to his study with Larsen, Anderson, and Odasso, Warne (2015) states that questions remain as to the academic benefits of AP classes for all students in a school. Some schools added AP programs, but saw AP exam pass rates languish below ten percent (Warne, 2015). According to Warne (2015), schools have been adding AP programs in significant numbers without independent research to verify the courses' value.

Santoli (2002) looked at a number of studies and summarized the results of those studies in a 2002 journal article. While many educators extol the benefits of a robust AP program, others argue that when AP programs track the upper-level students into classes

together, the lower-level students could suffer academically (Santoli, 2002). Santoli (2002) states that schools also tend to place their most effective teachers into AP courses, sometimes robbing the students who most need the higher skilled teachers of their services.

AP Classes and Lower Achieving Students

For lower achieving students, the effects of selecting the more rigorous AP courses are mixed. Miron (2008) studied the effects on AP exam results and GPA in a large suburban high school following a relaxation of AP enrollment criteria. Using a one-way analytic procedure analysis of covariance (ANCOVA), Miron compared the AP test scores of 328 students in 2006 with the scores from 392 students in 2007 (Miron, 2008).

The schools implemented the criteria change in spite of concerns that allowing the “fringe” students in the courses could have a detrimental effect on the high-achieving students who would have been granted acceptance under the previous entry criteria. The aforementioned entry criteria varied from course to course, but generally included an entry exam in the spring of the year before the class was taken.

Teachers at the school were encouraged to relax admission standards in order to allow lower achieving students into their AP courses. At the school, the number of AP enrollees increased by 20% between the two years studied (Miron, 2008). Miron’s study found that AP test score averages remained the same the year after the “fringe” students were allowed in the courses. In fact the mean scores actually increased, though not enough to be significant statistically. Miron also found that average grades in the classes did not decrease after relaxing the admission requirements. Miron did find that the fringe students’ AP test scores were about 0.5 points below their counterparts’ (Miron, 2008).

Overall, Miron concluded that while the fringe students' AP scores were lower than their counterparts', the fringe students' class grades were similar to the traditional AP students, and the fringe students' presence in the classes did not decrease the performance of the traditional AP students (Miron, 2008).

Colgren (2014) used data from the Illinois Department of Education to study the impact taking even a single AP course would have on a student's ACT score. Using AP scores from over 140,000 students, Colgren found via an analysis of variance (ANOVA) that students who took an AP course scored higher on the ACT than their classmates who enrolled in lower rigor courses. Interestingly, he found that taking the AP courses correlated to a greater increase in ACT scores for white and non-low-income students than for non-white and low-income students (Colgren, 2014). The data analyzed by both of these studies indicated similarly that the positive impacts of selecting additional AP courses appeared to outweigh any negative effects for all students who completed the courses. (Colgren, 2014; Miron, 2008).

The ACT in Arkansas

Beginning in the 2015-2016 school year, Arkansas public schools began giving the ACT and ACT Aspire exclusively as the official state tests (Worsham, 2018). Every student in Arkansas now takes the ACT examination in the spring of the student's junior year (Pritchett, 2018). In 2017, Arkansas's average ACT Composite score was 19.4 on a scale of one to 36, while the United States national average the same year was 21.0 (ACT, Inc., 2017).

Just over 34,000 Arkansas students took the ACT examination in 2017 (ACT, Inc., 2017). Arkansas students' ACT Mathematics scores nearly reflected their composite

scores. Arkansas students averaged 19.0 in math, while the United States average was 20.7 (ACT, Inc., 2017). According to College Raptor, almost 88% of Arkansas high school students reported ACT scores to the colleges where they were applying while less than 10% of New Jersey high school students reported ACT scores to colleges (Wignall, 2019). Clearly, ACT scores are particularly important to Arkansas students.

Summary

The review of related literature began with broad background information about testing in general, stating the importance of a strong performance on the ACT exam for college acceptance. The chapter then moved into the conceptual framework, using Structural Functionalism as a basis for how schools use standardized testing to track students into colleges (Pai & Adler, 2001).

The history of both the ACT and SAT were presented, with the researcher sharing the readiness scores that have been shown to correlate to success in college classes (ACT, Inc., 2017; Allen & Radunzel, 2017). The readiness scores were followed by a statement of the ACT scores that allow students to enter college without being enrolled in remedial classes. In two Arkansas universities, that ACT score is 19 and 20 (Arkansas Tech, 2019; University of Arkansas, n.d.). The researcher discussed accountability at length, beginning with *A Nation at Risk*, then No Child Left Behind, before ending with how Arkansas meets the current ESEA regulations (Wodiska, 2018).

The chapter concluded with a look at the effects of students taking AP courses. The researcher showed the positive and negative effects of students taking the advanced courses. The positive effects included higher ACT scores when students enrolled in AP classes, finished those classes, and completed the AP exams (Connifey-Marlin, 2016;

Warne, Larsen, Anderson, & Odasso, 2015). However, Santoli (2002) concluded that schools including AP courses may actually have a negative effect on lower levels of students.

Two studies analyzed the effects of accepting lower achieving students into Advanced Placement courses. Using an ANCOVA, Miron determined that when the school accepted more lower-achieving students into their AP program by relaxing their entry criteria, the average class GPA remained unchanged. The fringe students' AP test scores were about half a point lower than their counterparts, but the non-fringe students' AP test scores and grades remained unchanged (Miron, 2008). Similarly, Colgren used an ANOVA to analyze student data from the Illinois Department of Education. His data indicated that taking AP courses helped students score higher on the ACT exam (Colgren, 2014).

CHAPTER 3: METHODOLOGY

This study measured the predictability of multiple factors on ACT scores. The study addressed students' academic ability by using the students' eighth grade Aspire scores. The research questions guiding this study were:

1. RQ1: What is the relationship between gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, the number of Pre-AP and AP courses taken by grade 11, and secondary students' ACT scores?
2. RQ2: For low-achieving students, what is the relationship between gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, the number of Pre-AP and AP courses taken by grade 11, and secondary students' ACT scores?
3. RQ3: For students who qualify for free or reduced lunch, what is the relationship between gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, the number of Pre-AP and AP courses taken by grade 11, and secondary students' ACT scores?
4. RQ4: What is the relationship between the number of Pre-AP and AP courses taken by grade 11 and secondary students' ACT scores?

The (null) hypotheses of this study were the following:

1. H_{01} : The following variables do not predict ACT subject area and composite scores: gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, and the number of Pre-AP and AP courses completed by grade 11.
2. H_{02} : The following variables do not predict ACT subject area and composite scores for low-achieving students: gender, socio-economic status, ACT Aspire

scores, ACT Aspire Readiness scores, and the number of Pre-AP and AP courses completed by grade 11.

3. H_{03} : The following variables do not predict ACT subject area and composite scores for students who qualify for free or reduced lunch: gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, and the number of Pre-AP and AP courses completed by grade 11.
4. H_{04} : The number of Pre-AP and AP courses completed by grade 11 does not predict ACT subject area and composite scores.

Participants

The results of the study will be generalizable to Bentonville West High School students for approximately the next five years, a time period the researcher chose because no substantial testing or curricular changes are predicted. Therefore the population will be approximately 3,000 students who matriculate through Bentonville West. The participants of the study, or sample, were members of the BWHS graduating class of 2019.

Data from a minimum of 116 participants were chosen from the BWHS class of 2019. To calculate the minimum sample size, Green (1991) proposed the formulas $54 + 8k$ to test the overall fit of the independent variables to predict the dependent variables or $104 + k$ to test if the individual independent variables are significant, where k equals the number of predictor variables. Green stated these formulas would be accurate general rules when determining minimum sample size for a multivariate regression. Because this study investigated both, the higher of the two values, which was yielded by the $104 + k$ formula, was used. In this study, the 12 predictor (independent) variables were the

students' eighth grade Aspire scores and readiness scores in math, English, reading, and science and the number of advanced courses the students selected in ninth, tenth, and eleventh grades. Students' gender and socioeconomic status, as determined by free or reduced lunch status, were used as independent variables as well.

The researcher used the BWHS graduating class of 2019 as the sample for this study. Over 300 students' data were used in the analysis. This number of students met Green's criteria for sample size (Green, 1991). Although all of the graduating class was included, statistical analysis employing SPSS used only the data from students who have attended Arkansas schools from eighth grade through 12th grade to perform the calculations.

This enrollment time period allowed the researcher access to eighth grade Aspire scores, numbers of advanced classes the students chose to take, and the students' ACT scores. The students' ACT Aspire score reports included a measurement of readiness for success on the ACT exam. Aspire subject area scores fell into one of four readiness levels: Needs Support, Close, Ready, or Exceeding (Worsham, 2018). This designation was used in the study to examine the effect the other variables, specifically the number of Pre-AP and AP classes the student takes, has on their ACT subject area and composite scores. The researcher used this designation to closely examine the lower achieving students' performance, an important part of this study.

Research Design and Method

This correlational study attempted to identify the nature and degree of predictability of a student's ACT scores using the eighth grade Aspire scores, number of Pre-AP and AP classes a student chose to take, gender, and socio-economic status. The

Bentonville West High School graduating class of 2019 was selected as the sample for this study. The researcher gleaned data from each student's records using the school's permanent record database. The data were initially entered into an Excel spreadsheet, then copied into SPSS where the regressions were run using a multivariate general linear hypothesis (MGLH) regression model.

Treatment and Procedures

This study was conducted using the following steps. After obtaining permission from the Arkansas Tech Institutional Review Board to proceed with the study, the researcher obtained permission from the superintendent of BPS to glean student data. Once both of these permissions were obtained, the researcher generated a list of students from the BWHS senior class of 2019. The researcher deleted all student names from the data, and each student was assigned a code number. From that point on, the students' code numbers were used in lieu of student names. More than 300 students' data were used for the study.

The following data were entered into columns on the data spreadsheet: student code number, gender, socio-economic status, ACT Aspire scale scores and Readiness scores for Math, English, Reading, and Science, the number of Pre-AP and AP courses taken in grades nine through 11, ACT Math score, ACT English score, ACT Reading score, ACT Science score, and ACT Composite score. The data were copied into SPSS and the variables were coded and labeled appropriately.

Once the data were present in SPSS, the researcher first ran descriptive statistics to gain a profile of the sample population. Once the descriptive statistics were established, the researcher ran the multivariate general linear model regressions. This

process determined whether predictability existed, and if so, which independent variables were useful in predicting the dependent variables, the ACT scores. The researcher then used the identified variables in subsequent regressions to determine the level of predictability for each.

Measurement

The data for this study were generated by the BWHS students and was recorded in the students' permanent school records. The data for the first independent variable, the eighth grade Aspire subject area scores, were generated in the spring of 2015 when the students took the Aspire test in their respective Arkansas schools. The Aspire scores were reported as scale scores, interval-level data, with a minimum and a maximum. The eighth grade math scores, for example, were reported on a scale from 400 to 456 (ACT, Inc., 2016). The scales were similar for grades three through 10, with the lower endpoint, 400, remaining constant, and the upper endpoint increasing each year from 434 in grade three to 460 in grades nine and 10 (ACT, Inc., 2016).

Accompanying each Aspire score was a readiness level score. The readiness level scores were used to compare students of similar academic acumen. For example, the researcher sorted the students by English readiness level, then ran the regressions within those readiness levels. The resulting findings could indicate whether enrolling in Pre-AP and/or AP courses would be beneficial to a particular readiness group.

The next independent (predictor) variable, the number of advanced classes taken in grades nine, ten, and eleven, was ratio-level, because students chose to take zero advanced classes or more. Students and their parents chose each school year's classes in

the spring of the previous year. Other independent variables included gender and socio-economic status (free or reduced lunch).

The dependent variables for this study were each student's ACT subject area scores for math, English, reading, and science, and the ACT Composite score. For this study's purposes, the ACT scores used were gleaned from the required official school administration in the spring of the students' junior year. The class being studied took the ACT examination in February of 2018. The interval-level scores for ACT range from one to 36 for each subject area (Pritchett, 2018).

Statistical Analysis

This study was designed to determine the predictability of ACT scores by a student's eighth grade Aspire scores and the number of Pre-AP and AP classes a student chooses to take in his or her ninth, 10th, and 11th grade years. The research questions guiding this study were:

1. RQ1: What is the relationship between gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, the number of Pre-AP and AP courses taken by grade 11, and secondary students' ACT scores?
2. RQ2: For low-achieving students, what is the relationship between gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, the number of Pre-AP and AP courses taken by grade 11, and secondary students' ACT scores?
3. RQ3: For students who qualify for free or reduced lunch, what is the relationship between gender, socio-economic status, ACT Aspire scores, ACT Aspire

Readiness scores, the number of Pre-AP and AP courses taken by grade 11, and secondary students' ACT scores?

4. RQ4: What is the relationship between the number of Pre-AP and AP courses taken by grade 11 and secondary students' ACT scores?

The (null) hypotheses of this study were the following:

1. H_{01} : The following variables do not predict ACT subject area and composite scores: gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, and the number of Pre-AP and AP courses completed by grade 11.
2. H_{02} : The following variables do not predict ACT subject area and composite scores for low-achieving students: gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, and the number of Pre-AP and AP courses completed by grade 11.
3. H_{03} : The following variables do not predict ACT subject area and composite scores for students who qualify for free or reduced lunch: gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, and the number of Pre-AP and AP courses completed by grade 11.
4. H_{04} : The number of Pre-AP and AP courses completed by grade 11 does not predict ACT subject area and composite scores.

Data generated from the BWHS graduating class of 2019 were employed for this correlational study. The researcher used SPSS to compute the data.

The Aspire subject area test scores, the number of Pre-AP and AP courses chosen, and the ACT subject area test scores were converted into means and standard deviations to present the descriptive statistics of each group. The descriptive statistics allowed the

researcher to quickly observe anomalies or trends for each variable. The researcher employed an MGLH to determine if the ACT scores can be predicted by the number of Pre-AP and AP courses at an alpha level of $p < .05$. Once the MGLH determined which independent variables could be useful in predicting the dependent variable, the researcher ran a simple regression with that single independent variable in order to determine its level of predictability.

Research Ethics

The data and identities from the generating students were well protected. Arkansas Tech's Institutional Review Board approved the methods and the overall study before any data were gleaned. In addition, permission to use student data was obtained from the superintendent of Bentonville Schools. Names of students were converted into numerical codes, and no student names were used anywhere in the study. All data were secured in password-protected files. Any hard copies of student-identifiable data were secured in a locked room and/or a locked file cabinet.

CHAPTER 4: RESULTS

The purpose of this correlational study was to explore the relationship between students' ACT Aspire scores, gender, socio-economic status, enrollment in Pre-AP and AP courses and their ACT scores. The researcher determined predictability of the dependent variables by the independent variables, and if predictability existed, determined the strength of the predictive relationship.

Descriptive Statistics

The data were generated by the Bentonville West graduating class of 2019, the sample population for this study. The sample consisted of 312 students who took the ACT Aspire examination in eighth grade and/or the ACT examination in the spring of their junior year. Descriptive data, including gender and socio-economic breakdown, ACT Aspire score information, number of advanced courses selected, and ACT scores are included in Table 1 and Table 2. For the socio-economic status study results, the researcher used free/reduced lunch status. The Aspire scores will be discussed in more detail later in this chapter.

Table 1

Descriptive Statistics - BWHS Class of 2019 ACT Aspire Scores and Number of Advanced Courses Selected (Independent Variables)

	Aspire English	Aspire Math	Aspire Reading	Aspire Science	Aspire Composite	Number Adv. Courses
N ^a	302	303	303	303	302	312
Mean	429.64	426.76	423.79	428.13	427.18	2.7
Median	430	426	424	428	427	1.5
Mode	435	426	426	425	427	0
Std. Dev.	9.999	7.288	7.658	7.711	7.175	3.062
Range	51	44	32	39	35	14
Min	400	408	407	406	410	0
Max	451	452	439	445	445	14

^aThe sample consisted of 312 students, with some missing portions of the Aspire exam. The sample was 47% male and 53% female, 27.9% Free/Reduced Lunch and 72.1% non-Free/Reduced Lunch.

Of the 312 students, 301 completed the ACT examination in the spring of their junior year. The students' mean ACT Composite score was 21.22, which was 1.72 points higher than the state mean for 2018 (ACT, Inc., 2018). The BWHS students outperformed the state averages in every subject area score as well (ACT, Inc., 2018).

Table 2

Descriptive Statistics - BWHS Class of 2019 ACT Scores (Dependent Variables)

	ACT English	ACT Reading	ACT Math	ACT Science	ACT Composite
N ^a	301	301	301	301	301
Mean	21.23	22.24	20.28	21.5	21.22
Median	21	22	19	21	21
Mode	16	22	16	24	18
Std. Dev.	6.958	6.639	4.716	5.322	5.342
Range	30	27	24	28	24
Min	6	9	11	7	11
Max	36	36	35	35	35

^aThe sample consisted of 312 students, with 11 missing each ACT subject area exam. The sample was 47% male and 53% female, 27.9% Free/Reduced Lunch and 72.1% non-Free/Reduced Lunch.

Research Questions and Hypotheses

The research questions guiding this study were:

1. RQ1: What is the relationship between gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, the number of Pre-AP and AP courses taken by grade 11, and secondary students' ACT scores?
2. RQ2: For low-achieving students, what is the relationship between gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, the number of Pre-AP and AP courses taken by grade 11, and secondary students' ACT scores?
3. RQ3: For students who qualify for free or reduced lunch, what is the relationship between gender, socio-economic status, ACT Aspire scores, ACT Aspire

Readiness scores, the number of Pre-AP and AP courses taken by grade 11, and secondary students' ACT scores?

4. RQ4: What is the relationship between the number of Pre-AP and AP courses taken by grade 11 and secondary students' ACT scores?

The (null) hypotheses of this study were the following:

1. H_{01} : The following variables do not predict ACT subject area and composite scores: gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, and the number of Pre-AP and AP courses completed by grade 11.
2. H_{02} : The following variables do not predict ACT subject area and composite scores for low-achieving students: gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, and the number of Pre-AP and AP courses completed by grade 11.
3. H_{03} : The following variables do not predict ACT subject area and composite scores for students who qualify for free or reduced lunch: gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, and the number of Pre-AP and AP courses completed by grade 11.
4. H_{04} : The number of Pre-AP and AP courses completed by grade 11 does not predict ACT subject area and composite scores.

Data Analysis

The researcher began the data analysis process by using SPSS to run a multivariate test in the General Linear Model. This test was chosen because the study involves potential predictors of multiple dependent variables (Salkind, 2017). The multivariate test minimizes the possibility of a Type 1 Error, which is a false positive,

causing the researcher to reject the null hypothesis incorrectly. The independent (predictor) variables examined in this study were gender, socio-economic status, number of Pre-AP and AP courses enrolled in by grade 11, ACT Aspire scores, and ACT Aspire Readiness scores. The dependent (criterion) variables were the ACT subject area and composite scores.

ACT Predictability for the Entire Sample

RQ1 addressed ACT predictability for the entire sample using all independent variables and dependent variables. The multivariate test yielded three independent variables as potential predictors of ACT scores at a confidence level of $p < .05$. Those variables were the number of advanced classes taken by grade 11 ($p = .005$), socio-economic status ($p = .033$), and the eighth grade ACT Aspire Reading score ($p = .023$). The general linear model multivariate test concluded that one or more of the independent variables does predict one or more of the dependent variables. Therefore, the null hypothesis H_{01} is rejected. The next step was to identify what independent variables predicted the ACT scores, and then to determine the strength of those predictive relationships.

In the test of between-subjects effects, the general linear model multivariate test determined that gender, number of advanced classes taken by grade 11, ACT Aspire English Readiness score, and ACT Aspire Writing score added significantly to the predictability of more than one of the dependent variables when the entire sample population is tested. Gender added to the predictability of ACT math scores ($p = .043$) and ACT Science scores ($p = .048$). The number of advanced classes taken by grade 11 helped predict more dependent variables than any other independent variable. The

number of advanced classes taken added to the predictability of the ACT English score ($p = .001$), the ACT Math score ($p = .003$), the ACT Science score ($p = .015$), and the ACT Composite score ($p = .001$).

When data from the general population was analyzed, the ACT Aspire English Readiness score was the only readiness score to add to the predictability of any ACT subject area or Composite score. The Aspire English Readiness score added to the predictability of the ACT English score ($p = .013$), the ACT Reading score ($p = .002$), and the ACT Composite score ($p = .003$). The ACT Aspire Writing scores also predicted three ACT scores, the English ($p = .013$), the Reading ($p = .029$), and the ACT Composite score ($p = .011$).

ACT Predictability for Low-Achieving Students

The researcher took specific interest in the low achieving students in the study. To address RQ2, low achieving students were defined as students who scored “Needs Support” or “Close” on any readiness area on the ACT Aspire. The researcher was attempting to determine which independent variables could potentially predict the ACT scores for the students who scored below the readiness threshold for each Aspire area. To test for predictability, the researcher ran the regression again, this time employing only the low achieving students’ scores for each Aspire readiness area.

Table 3

BWHS Class of 2019 Aspire Readiness Scores

Aspire Readiness Score Area	Number Tested (n)	Needs Support or Close	Ready or Exceeds
English	302	21.80%	78.10%
Reading	303	46.90%	53.10%
Math	303	37.30%	62.70%
Science	303	42.60%	57.40%
Writing	301	53.10%	46.90%

The students' eighth grade ACT Aspire Readiness scores were collected from their permanent records. Students demonstrated readiness in English at a considerably higher level than in math, science, or writing. Writing Readiness was the area in which the students recorded the lowest scores. According to the Aspire results, over half of the students failed to achieve a "Ready" score. Only two students (0.6%) scored in the "Exceeding" category.

The researcher looked at each of the ACT Aspire subject area readiness scores, isolated the data from the students whose scores fell into the "Needs Support" or "Close" categories, then ran multivariate regressions with those students' data to determine which independent variables contributed to the predictability of the five dependent variables, the ACT subject area and composite scores. Each population tested yielded at least two independent variables that added to the predictability of the ACT scores. The number of advanced courses taken by grade 11 added to the predictability of the ACT scores for each population tested. The ACT Aspire Composite score also contributed to predictability of ACT scores in a number of the scenarios.

ACT Aspire English Readiness.

The data showed that 66 students' Aspire English scores fell in the "Needs Support" or "Close" categories for readiness. It is important to note that, using Green's formula for sample size, the 66 students' data did not meet the minimum sample size for statistical significance (Green, 1991). The researcher continued with the testing to identify trends that might warrant similar additional testing in the future.

Using the data for these 66 students only, the multivariate linear regression determined that there was at least one independent variable that added to the predictability of at least one dependent variable, therefore the researcher continued to determine which independent variables demonstrated predictability. The test of between-subjects yielded the following results. Two independent variables significantly added to the predictability of the ACT scores, the number of advanced courses the student completed by grade 11 and the ACT Aspire Composite score.

The number of advanced courses taken added to the predictability of ACT English scores ($p = .022$), ACT Reading scores ($p = .006$), ACT Math scores ($p = .005$), ACT Science scores ($p = .002$), and the ACT Composite scores ($p = .001$). The ACT Aspire Composite score added to the predictability of the ACT Science score ($p = .050$) and the ACT Composite score ($p = .045$).

ACT Aspire Math Readiness.

The researcher repeated the procedure for the 113 students who scored below "Ready" on the math portion of the ACT Aspire test. Like the English testing, the sample population fell short of Green's minimum formula to be statistically significant (Green,

1991). The researcher opted to continue testing to determine if future testing with additional data may be warranted.

Using these students' data in a multivariate linear regression yielded at least one independent variable that contributed to the predictability of one or more of the dependent variables. The between-subject test results indicated that, for this group of students, gender added significantly to the predictability of the ACT English scores ($p = .026$).

The number of advanced courses taken by grade 11 contributed significantly to the predictability of all five dependent variables for these 113 students: ACT English ($p < .001$), ACT Reading ($p = .022$), ACT Math ($p = .017$), ACT Science ($p = .001$), and ACT Composite ($p < .001$). For this same group, socio-economic status significantly added to the predictability of ACT English scores ($p = .028$) and the ACT Composite scores ($p = .044$). The students' Aspire Writing scores contributed significantly to the predictability of ACT Math scores ($p = .041$) and ACT Composite scores ($p = .041$). The ACT Aspire Reading score contributed significantly to the predictability of the ACT Reading score ($p = .012$), and the ACT Aspire Composite score added significantly to the predictability of the ACT Composite score ($p = .032$).

ACT Aspire Reading Readiness.

The 142 students who failed to meet the "Ready" classification on the ACT Aspire Reading test comprised a sample large enough to be statistically significant for this study (Green, 1991). The multivariate test yielded two independent variables that showed that some level of predictability existed for the dependent variable ACT scores,

the number of advanced courses taken by grade 11 ($p < .001$) and the ACT Aspire Reading Readiness score ($p = .031$).

The test of between-subjects effects results indicated that several independent variables added to the predictability of the ACT scores. The number of advanced courses taken by grade 11 contributed to the predictability of all of the independent variables in the study: ACT English scores ($p < .001$), ACT Reading scores ($p = .008$), ACT Math scores ($p < .001$), ACT Science scores ($p = .002$), and the ACT Composite score ($p < .001$).

Socio-economic status added to the predictability of the ACT English score ($p = .005$). ACT Aspire Reading scores added to the predictability of the ACT Composite score ($p = .030$). The ACT Aspire Reading Readiness score contributed to the predictability of the ACT Composite score ($p = .045$), while the ACT Aspire Writing score added to the predictability of the ACT Reading scores ($p = .016$). Finally, the ACT Aspire Writing Readiness score added to the predictability of the ACT Reading scores ($p = .002$) and the ACT Composite score ($p = .035$), and the ACT Aspire Composite score contributed to the predictability of the ACT Composite score ($p = .044$).

ACT Aspire Science Readiness.

On the ACT Aspire Science test, 129 students' scores fell into the "Needs Support" or "Close" categories. This number of students met Green's threshold for statistically significant sample size (Green, 1991). Four independent variables demonstrated some level of predictability in the multivariate test at $p < .050$. Those variables were the number of advanced courses chosen by grade 11 ($p = .021$), gender (p

= .014), ACT Aspire English Readiness score ($p = .042$), and ACT Aspire Science Readiness score ($p = .004$).

In the test of between-subjects effects, the data showed that six independent variables added to the predictability of one or more of the ACT scores. Gender added to the predictability of ACT English scores ($p = .001$) and ACT Reading scores ($p = .047$). The number of advanced courses taken by grade 11 added to the predictability of ACT English scores ($p = .001$), ACT Reading scores ($p = .011$), ACT Science scores ($p = .017$), and the ACT Composite scores ($p = .001$). Socio-economic status added to the predictability of ACT English scores ($p = .044$).

Three ACT Aspire Readiness scores contributed to the predictability of ACT scores for this population. ACT Aspire English Readiness scores added to the predictability of ACT Reading scores ($p = .041$). ACT Aspire Science Readiness scores added to the predictability of ACT Math scores ($p = .009$), and ACT Aspire Writing Readiness scores added to the predictability of ACT Reading scores ($p = .025$).

ACT Aspire Writing Readiness.

On the ACT Aspire Writing test, the BWHS class of 2019 logged their lowest readiness scores. Over half of the class failed to reach the “Ready” minimum score. The 160 students who fell into this category easily met the minimum population needed per Green’s formula for statistical significance (Green, 1991). The multivariate test produced two dependent variables that indicated a level of predictability at $p < .050$, the number of advanced courses chosen by grade 11 ($p < .001$) and the students’ lunch status ($p = .018$). Because these variables showed a level of predictability, the researcher continued with

the test of between-subjects effects to determine which independent variables added to the predictability of the dependent variables, ACT scores.

The number of advanced courses taken by grade 11 contributed significantly to the predictability of all five of the dependent variables: ACT English scores ($p = .007$), ACT Reading scores ($p = .046$), ACT Math scores ($p < .001$), ACT Science scores ($p = .026$), and ACT Composite scores ($p < .001$). Lunch status added to the predictability of ACT English scores ($p = .003$) and ACT Math scores ($p = .010$). Finally, ACT Aspire English Readiness scores contributed to the predictability of ACT Reading scores ($p = .013$).

R-squared values for the dependent variables.

As part of the test of between-subjects-effects, the multivariate linear regression yielded R-squared values for each dependent variable. The R-squared statistic is a measure of the correctness of the data fitting into the regression model (Corporate Finance Institute, 2019). It is calculated by subtracting the quotient of the sum of squares due to regression by the total sum of squares from one (Corporate Finance Institute, 2019). Because this quotient is always a positive real number between zero and one, the R-squared value also always falls between zero and one, yielding a percentage. In general, a higher R-squared value specifies a superior correspondence for the model. In addition to calculating the R-squared value, SPSS also calculated the adjusted R-squared value, which adjusts the value based on the number of independent variables (Ogee, Ellis, Scibilia, Pammer, & Steele, 2013). The greatest adjusted R-squared value was generated for the ACT Composite score (adjusted $R^2 = .822$). The ACT English score generated an adjusted R-squared value of .782. The adjusted R-squared values for the ACT Math and

Reading scores, respectively, were .753 and .674. SPSS calculated the lowest adjusted R-squared value for the ACT Science score (adjusted $R^2 = .655$).

Predictive equations.

To generate predictive equations for each dependent variable, the researcher ran stepwise linear regressions using each ACT score as the dependent variable. Like a regular linear regression, the stepwise regression generated predictive equations for each dependent variable. The stepwise regression, however, excludes independent variables that do not contribute to the predictability of the dependent variables. The stepwise model generates multiple equations based on the number of potentially predictive independent variables.

For each dependent variable, the researcher chose a reasonable equation to list from the equations SPSS generated based on the principle of parsimony. The principle of parsimony contends that the simplest explanation should be considered for a phenomenon while still maintaining a quality process to reach the conclusion (Statistics, 2015). For predictive studies like this one, parsimonious models (equations) are the simplest with the greatest predictive power. These equations contained multiple independent variables along with their coefficients and a constant (intercept). The generated equations were divided into three sections: general predictive equations, equations predicting scores for students who receive free or reduced lunch, and predictive equations using the number of advanced courses chosen. The multiple linear regression equations generated follow the general format: $y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_kx_k + \varepsilon$ where y = outcome, β_0 = constant, β_i = correlation coefficient, x_i = predictor variable, k = the number of predictor variables and ε = the error.

General Predictive Equations.

The first set of equations was generated from using all of the independent variables to see which were useful in predicting each dependent variable. The entire sample population was used to generate these equations. For each dependent variable, the ACT Aspire Composite score turned out to contribute to the predictability. It was the strongest predictor in each case. The number of advanced courses chosen contributed to the predictability of four of the five dependent variables, with Aspire Math scores and lunch status also contributing to a lesser degree.

For each of these equations, the dependent variable was stated, while the term “independent variables” was used to represent free/reduced lunch status, gender, ACT Aspire subject area and composite scores, ACT Aspire Readiness scores, and the number of advanced courses chosen.

Multiple linear regressions were calculated to predict each ACT score based on the independent variables: lunch status, gender, ACT Aspire subject area and composite scores, ACT Aspire Readiness scores, and the number of advanced courses chosen. Based on a parsimony study, a useful regression was determined for each dependent variable. For English ACT scores, for example, a significant regression equation was found ($F(3,288) = 194.066, p = 0.000$), with an adjusted R^2 of .772. The English ACT score is equal to $-267.32 + .067(\text{Aspire Comp score}) + 0.45(\text{Number of Advanced Courses}) - 1.40(\text{Lunch Status})$. For each equation, $p = 0.000$, which meets the $p < .05$ criteria. The resulting regression equations are listed in Table 4. The adjusted R-squared value, regression value, residual value, and F value for each equation are listed in Table

A1 in the appendix. When used, free/reduced lunch status is coded as 0 = not qualifying and 1 = qualifying.

Table 4

Reasonable Predictive Equations for All Dependent Variables and All Independent Variables

ACT Score	Constant	Coef 1	Predictor Variable 1	Coef 2	Predictor Variable 2	Coef 3	Predictor Variable 3
English	-267.32	0.67	Aspire Comp	0.45	#AP to Gr 11	-1.40	Lunch Status
Reading	-240.93	0.61	Aspire Comp	0.40	#AP to Gr 11		
Math	-175.25	0.24	Aspire Comp	0.22	Aspire Math	0.35	#AP to Gr 11
Science	-186.25	0.48	Aspire Comp	0.32	#AP to Gr 11		
Composite	-203.69	0.52	Aspire Comp	0.37	#AP to Gr 11	-0.98	Lunch Status

Note: The first row of the table would be calculated as: ACT English Score = -267.31 +0.67*(Aspire Composite Score)+0.45*(Number of Advanced Courses Completed) -1.40(Lunch Status). For Lunch Status, students who receive free or reduced lunch were assigned a one. Students who did not receive free or reduced lunch were assigned a zero. The abbreviation #AP to Gr 11 corresponds to the number of advanced courses students chose up to their grade 11. Each equation has a significance of 0.000.

Free/Reduced Lunch.

The second set of equations was produced by completing stepwise linear regressions for each dependent variable with all of the independent variables. The researcher used data from the 87 students who qualified for free or reduced lunch to address RQ3. Although this number of students does not meet the minimum for a significant sample, the researcher continued with the process to determine findings that could be further investigated in the future using a larger sample. The results were similar

to those from the general population in that the ACT Aspire Composite score contributed significantly to the dependent variable predictability for each of the five ACT scores used as dependent variables. ACT Aspire Math scores, ACT Aspire Science scores, and the number of advanced courses chosen were also shown to contribute to the model's predictability for at least one equation each.

With the data set paired down to the students who qualified for free/reduced lunch, multiple linear regressions were calculated to predict each ACT score based on the independent variables. A useful regression was chosen for each dependent variable based on a parsimony study. The results are listed in Table 5. For each equation, $p < .001$, which meets the $p < .05$ criteria.

Table 5

Reasonable Predictive Equations for All Dependent Variables and All Independent Variables for Students who Receive Free or Reduced Lunch

ACT Score	Constant	Coef 1	Predictor Variable 1	Coef 2	Predictor Variable 2	Adj R ²
English	-304.77	0.76	Aspire Comp			0.670
Reading	-301.94	0.95	Aspire Comp	-0.191	Aspire Science	0.673
Math	-148.20	0.26	Aspire Comp	0.135	Aspire Math	0.496
Science	-180.94	0.47	Aspire Comp	0.426	#AP to Gr 11	0.530
Composite	-209.01	0.54	Aspire Comp	0.265	#AP to Gr 11	0.749

Note: The first row of the table would be calculated as: ACT English Score = - 304.77 + 0.76*(Aspire Composite Score). The abbreviation #AP to Gr 11 corresponds to the number of advanced courses students chose up to their grade 11. Each equation has a significance of 0.000.

Number of Advanced Courses Completed.

For the next set of equations generated, the researcher chose to parse the model in an attempt to determine the predictability of the number of advanced courses students completed. Since the ACT Aspire Composite score seems to remain constant as a predictor in this study, the researcher chose to investigate the predictive ability of the number of advanced courses completed as the lone predictor of the ACT scores using the following process (RQ4).

The third set of equations represents linear regressions produced by comparing the number of advanced courses completed to each dependent variable individually. For this set of equations, the constant represents the mean of the ACT scores if the student had not taken any advanced courses. The coefficient represents the amount the ACT scores increased on average for each advanced course a student completed. The lower bound and upper bound statistics represent the predictive variance for the coefficient. For example, the mean ACT English score was 16.6 for students who had not completed any advanced courses. For each advanced course a student completed, the student's ACT English score could be expected to increase by 1.7 points on average, with the majority of the predictive coefficients falling between 1.48 and 1.83. Therefore, if a student completed three advanced courses, his or her ACT English score could be expected to land around 22. The adjusted R-squared statistic shows how much of the predictability of the dependent variable can come from each equation. Each of the adjusted R-squared statistics for this set of equations fell between .45 and .57, with the ACT Composite score equation yielding the highest contribution to predictability.

Table 6

Reasonable Predictive Equations for All Dependent Variables and the Number of Advanced Courses Completed

ACT Score	Constant	Coefficient	Lower Bd	Upper Bd	Adj R ²
English	16.62	1.66	1.48	1.83	0.538
Reading	18.15	1.47	1.29	1.65	0.464
Math	17.19	1.11	0.99	1.23	0.524
Science	18.25	1.17	1.02	1.31	0.454
Composite	17.58	1.31	1.18	1.44	0.570

Note: The first row of the table would be calculated as: ACT English Score = 16.62 + 1.66*(Number of Advanced Courses Completed). Each equation has a significance of 0.000.

In summary, all four of the null hypotheses were rejected as several of the independent variables were shown to contribute to the predictability of the ACT scores (the dependent variables). In the investigation of RQ1, ACT Aspire Composite score and the number of advanced courses chosen were shown to be the independent variables that contributed most often to the predictability of the dependent variables. The second research question (RQ2) investigation employed data from the students whose ACT Aspire subject area readiness scores fell in the “Needs Support” and “Close” categories. The researcher discussed ACT predictability at length for these lower achieving students. The data was disaggregated by each of the ACT Aspire subject areas where the students recorded the lower readiness scores. In each subject area, at least one of the independent variables contributed to the predictability of the dependent variables.

The researcher then investigated ACT score predictability for the students who were classified in a lower socio-economic strata (RQ3), which was defined as free or reduced lunch eligibility. Like the majority of the results for each group studied, the ACT

Aspire Composite score turned out to be the largest contributor to the predictability of every ACT subject area and composite score.

Finally, the number of advanced courses chosen was investigated to determine its level of predictability (RQ4). The researcher ran linear regressions to determine predictability, but used the number of advanced classes as the lone independent variable. The resulting predictive equations were recorded in Table 6. The coefficients of the equations were generated and recorded. When the coefficients were multiplied by the number of advanced classes chosen and added to the score means from students who did not take any advanced courses, the equations predicted the ACT subject area scores and the ACT Composite score.

CHAPTER 5: CONCLUSIONS

The purpose of this correlational study was to explore the potentially predictive relationship between students' ACT Aspire scores, gender, socio-economic status, enrollment in Pre-AP and AP courses and their ACT scores. The impetus for this focus was derived from the Bentonville Schools' initiative to enroll more students in advanced courses. The researcher measured the level of predictability choosing these advanced courses would have on students' ACT scores. As evidenced in chapter four, several potentially predictive relationships were found to exist, thus justifying the rejection of the null hypothesis.

Summary of Methodology and Findings

The research questions guiding this study were:

1. RQ1: What is the relationship between gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, the number of Pre-AP and AP courses taken by grade 11, and secondary students' ACT scores?
2. RQ2: For low-achieving students, what is the relationship between gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, the number of Pre-AP and AP courses taken by grade 11, and secondary students' ACT scores?
3. RQ3: For students who qualify for free or reduced lunch, what is the relationship between gender, socio-economic status, ACT Aspire scores, ACT Aspire Readiness scores, the number of Pre-AP and AP courses taken by grade 11, and secondary students' ACT scores?

4. RQ4: What is the relationship between the number of Pre-AP and AP courses taken by grade 11 and secondary students' ACT scores?

The Bentonville West study results demonstrate that the research questions were answered comprehensively.

This study used the Bentonville West High School graduating class of 2019 as the sample population. The class consisted of over 400 students, over 300 of whom took the ACT Aspire in grade eight as well as the ACT examination as juniors in high school. The Aspire scores, along with gender, socio-economic status, and the number of advanced courses chosen served as the independent variables for this study. The subject area ACT scores as well as the ACT Composite score served as the dependent variables for this study. Once the data was entered into SPSS, the researcher initially ran a multivariate regression to determine if any of the variables contributed to the predictability of the ACT scores. The regression indicated that predictability did exist, therefore the null hypothesis was rejected. Once the potential for predictability had been established, additional multiple regressions were run to determine the level of predictability for each dependent variable.

The results of the multiple regressions included determining predictability equations for each dependent variable. The first coefficient in each equation is paired with the independent variable that contributed most significantly to predictability. In each equation, the first coefficient was the ACT Aspire Composite score. The other independent variable that showed up often as a coefficient was the number of advanced courses chosen. The researcher chose reasonable predictability equations for each dependent variable and listed them in Table 6.

Lower Achieving Students and ACT Predictability

In addition to studying the predictors of ACT scores in general (RQ1), this study went further in researching three additional areas of interest. The first of these areas included a closer look at the data from students whose ACT Aspire Readiness scores fell below the “Ready” designation (RQ2). The researcher determined which independent variables contributed to the predictability of the dependent variables by running regressions for each of the ACT scores. For this group of students, the ACT Aspire Composite score repeatedly turned out to contribute the most to predictability of the ACT scores.

Free/Reduced Lunch Students and ACT Predictability

Like the general population of students, the ACT Aspire Composite score proved again to contribute the most to ACT score predictability for the 87 students who qualified for free or reduced lunch. Other ACT Aspire scores and the number of advanced courses chosen turned out to contribute to ACT score predictability to a lesser degree for these students (RQ3). Table 5 summarized this information.

Predictability from the Number of Advanced Courses Chosen

The third additional area of interest in this study was to determine the level of predictability of choosing advanced courses on the ACT scores (RQ4). Other than the ACT Aspire Composite score, the number of advanced courses showed up repeatedly as a contributor to predictability. In order to determine the predictability level, the researcher ran regressions using the number of advanced courses chosen as the lone independent variable. The results are displayed in Table 6, and indicated that the number of advanced

courses did play a role in predictability. In each case, this independent variable produced a coefficient of between 1.11 points and 1.66 points, which indicates a potential positive correlation between the number of advanced courses selected and the ACT scores.

Implications for Practice

General Implications

The data from the Bentonville West study indicated that predictability existed for the dependent variables, the ACT scores. The ACT Aspire Composite score was the most significant contributor to predictability in each regression equation, followed by the number of advanced courses chosen. The data indicate that the number of advanced placement courses was positively correlated to ACT scores. Therefore the selection of advanced courses could be considered by schools as a potential predictor of ACT scores. The choice to select advanced courses occurs three times during a student's high school career before the student takes the ACT examination in the junior year. School administrators should embrace programs that increase participation in advanced courses, educate students and parents about the benefits of taking advanced courses, and remove barriers to enrolling in the advanced courses. These initiatives to place more students into advanced courses are consistent with Miron's study and Colgren's study that both determined that the benefits of lower achieving students enrolling in advanced courses outweigh the negatives (Colgren, 2014; Miron, 2008).

In addition, high schools should partner with middle schools and junior high schools in an attempt to prepare students for advanced courses when they begin high school. Logically, these attempts to prepare students in the lower grades should also

improve the students' ACT Aspire Composite scores which were shown to be the strongest predictor of ACT scores. The study demonstrated that the students will benefit proportionally as they take more advanced courses. If a student comes to high school prepared for advanced courses, he or she will have the opportunity to take more of the courses and reap more of the benefit on the ACT examination.

Support for Lower-Achieving Students

For the lower-achieving students, there are several implications resulting from this study. Bentonville Schools would like to see the ACT scores for these students increase significantly. One implication here is to target these students with remediation efforts at earlier ages so that they are never classified as “lower-achieving.” Based on this study, if schools can improve these students' skills to the point where they are “Ready” or “Exceeding” by the eighth grade, they will achieve at a higher level on the ACT examination. It follows that the students would then be more likely to be accepted into colleges, avoid remedial courses, receive more scholarship dollars, and remain in college longer than they would if they enrolled with a lower score (Arkansas Tech, 2019; Pritchett, 2018; University of Arkansas, n.d.).

Another implication for practice involves the effects of students selecting advanced courses in grade 11 and below, one of the foci of this study. The study data indicated that students choosing to take advanced courses proved repeatedly to be one of the two most useful variables in predicting ACT scores. If school districts wish to improve ACT scores, administration and school staff should be educating stakeholders on the importance of selecting advanced courses, and encouraging students to enroll in those advanced courses. Although some studies conclude that an Advanced Placement program

can have negative effects on students and staff, the preponderance of research data indicate that the positive effects far outweigh the negative (Connifey-Marlin, 2016; Santoli, 2018; Warne, Larsen, Anderson, & Odasso, 2015). In the Bentonville West study, neither the grades in the advanced classes nor the scores on the AP examinations were considered as variables in this study. The students merely had to complete one or more advanced courses to predict a higher score on his or her ACT examination. Like the Miron (2008) study, the Bentonville West study concluded that taking advanced courses was a factor in predicting ACT scores for lower-achieving students. This resulting data could and should be presented on Advanced Placement parent nights and informational sessions.

Recommendations for Additional Research

In the future, researchers could continue a similar study in a number of ways. Like the studies completed by Colgren (2014) and Warne et al. (2015), a significantly larger number of student records could be included in the study. An increased sample size from a larger geographic area would specifically address two of the limitations and delimitations of the Bentonville West study. Colgren used thousands of students' data from the Illinois Department of Education, while Warne, et al. employed data from thousands of Utah students (Colgren, 2014; Warne. Et al, 2015). The large number of students involved in these studies could strengthen the possibility of transferability to other sizes of schools and areas of the country. A researcher could create an even bigger sample by combining populations of multiple states into a study, or performing a meta-analysis of existing state, regional, or school-specific studies.

Another option for additional study would be the introduction of advanced course grades and AP Examination scores as additional independent variables into a study similar to the one completed here. Many of the existing research studies stressed the need for students to complete the advanced course and take the corresponding exam (Connifey-Marlin, 2016; Warne et al., 2015). Adding the course grades and exam grades would add a depth and richness to the study and could further inform the discussions school staffs have with students and parents prior to course selection.

A future researcher could also consider other factors that could affect ACT scores. For example, student involvement in fine arts, athletics, or other extracurricular or co-curricular programs could be included as independent variables. These potential predictor variables could be quantified by the number of programs the student is involved in or the number of years the student is involved in the type of program. These additional independent variables could help to minimize one of the limitations of the Bentonville West study, which was the exclusion of additional factors that could potentially affect ACT scores.

Conclusion

When one looks at the findings of this study, a number of compelling findings stand out as noteworthy. First, the ACT Aspire Composite score was repeatedly shown to contribute most significantly to ACT score predictability. In the general predictability equations generated, the ACT Composite score was the strongest predictor for all five ACT scores, the dependent variables. For all but one ACT score, the second most significant contributor to predictability was the number of advanced courses chosen. The ACT Math score was the only exception. While the Aspire Composite score was still the

most significant contributor to predictability, the ACT Aspire Math score was the second most significant contributor to the ACT Math score.

Interestingly, the Aspire subject area scores did not contribute significantly to the predictability of the corresponding ACT subject area scores. Obviously, all of the Aspire subject area scores are included in the calculation of the Aspire Composite score. In that sense, they do contribute to predictability. However, the lack of corresponding subject predictability was surprising.

In almost every scenario studied the data indicated that, other than the Aspire Composite score, advanced course enrollment contributed most significantly to the predictability of ACT scores. Schools should do more to educate students and parents of the benefits of taking these courses. Middle schools and junior high schools can have a positive impact on students' futures by preparing students to take advanced courses as soon as possible. This preparation would benefit students in two ways. The students could take more advanced courses throughout high school and the students' ACT Aspire scores would likely improve.

Programs like Equal Opportunity Schools can help school administrators remain focused on moving more students into advanced courses (Equal Opportunity Schools, 2019). The financial cost for EOS is significant. Only schools can decide if the benefits of the program outweigh the cost. Schools can mimic the program internally, but they must do so very intentionally and with fidelity. The initiative must remain a continuous emphasis to maximize effectiveness.

ACT scores for students who qualify for free or reduced lunch continue to lag behind their counterparts who do not qualify. This gap has plagued educators for decades. While the researcher did not attempt to generate a causal relationship between the independent and dependent variables, the data from this study indicated that the selection of advanced courses was positively correlated to higher ACT scores. Therefore, increasing enrollment in advanced courses for students classified as low socio-economic status could correlate to increased ACT scores for the students.

Finally, the researcher used the number of advanced courses selected as the sole independent variable to test for predictability of ACT scores. The resulting data indicated a predictive correlation. In the resulting regression equations, the greatest adjusted R-squared value was only 0.570, indicating a weaker fit to the regression line than some of the other regression equations generated in the study that used multiple independent variables. That said, the number of advanced courses selected clearly contributed to the prediction of ACT scores to a degree.

While this was not a causal study, the resulting data can be used to inform decisions made by educators in determining best practice in their schools. The selection of advanced courses consistently added to ACT score predictability in each of the four scenarios researched. The correlation data should reinforce efforts to enroll more students in advanced courses.

References

- ACT, Inc. *Score scale*. (2016). Retrieved from
<https://www.discoveractaspire.org/assessments/score-scale/>
- ACT, Inc. (2017). *The ACT profile report - state graduating class 2017 Arkansas*.
Retrieved from <http://www.act.org/content/act/en/research/pdfs/act-state-profile-report-2017-Arkansas.html>
- ACT, Inc. (2018). *The ACT profile report - state graduating class 2018 Arkansas*.
Retrieved from <http://www.act.org/content/act/en/research/pdfs/act-state-profile-report-2018-Arkansas.html>
- ACT, Inc. (2019). *The ACT profile report - state graduating class 2019 Arkansas*.
Retrieved from <http://www.act.org/content/act/en/research/pdfs/act-state-profile-report-2019-Arkansas.html>
- ACT, Inc. *The ACT test for students*. (2019). Retrieved from
<http://www.act.org/content/act/en/products-and-services/the-act.html>
- Alcocer, P. (2019). *History of standardized testing in the United States*. Retrieved from
<http://www.nea.org/home/66139.htm>
- Allen, J., & Radunzel, J. (2017). *What are the ACT college readiness benchmarks* (Issue Brief). Retrieved from <https://www.act.org/content/dam/act/unsecured/documents/pdfs/R1670-college-readiness-benchmarks-2017-11.pdf>

- Arkansas Department of Education: Division of Elementary & Secondary Education.
(2019). *Report card*. Retrieved from <http://www.arkansased.gov/divisions/public-school-accountability/school-performance/report-card>
- Arkansas Tech University. (2019). *Unconditional admissions requirements*. Retrieved from <https://www.atu.edu/admissions/requirements.php>
- Atkinson, R., & Geiser, S. (2009). Reflections on a century of college admissions tests. *Educational Researcher*, 38(9), 665-676. doi:10.3102/0013189X09351981
- Bentonville Schools. *Bentonville schools high school course catalog 2018-2019* (2018).
Retrieved from <https://www.bentonvillek12.org/site/handlers/filedownload.ashx?moduleinstanceid=34508&dataid=30757&FileName=HS%20Course%20Catalog%20January%202018.pdf>
- Brenchley, C. (2015). *What is ESEA?* Retrieved from <https://blog.ed.gov/2015/04/what-is-esea/>
- Colgren, C. C. (2014). *Equality of opportunity: The relationship between tracking and educational outcomes*. Retrieved from <https://core.ac.uk/download/pdf/48840925.pdf>
- College Board. (2019). *What is AP?* Retrieved from <https://apstudents.collegeboard.org/what-is-ap>
- College Board. *Work toward college success*. (2019). Retrieved from <https://apstudent.collegeboard.org/exploreap/the-rewards>

Connifey-Marlin, A. (2016). *The effects of advanced placement courses on ACT scores*
[Unpublished doctoral dissertation]. Union University.

Corporate Finance Institute. (2019). *R-squared - definition, interpretation, and how to calculate*. Retrieved from
<https://corporatefinanceinstitute.com/resources/knowledge/other/r-squared/>

Edwards, N. T. (2006). The historical and social foundations of standardized testing:
In search of a balance between learning and evaluation. *Shiken: JALT Testing and Evaluation SIG Newsletter*, 10(1), 8-16. Retrieved from
http://hosted.jalt.org/test/edw_1.htm

Equal Opportunity Schools. (2019). Retrieved from <https://eoschools.org/>

Green, S. B. (1991). How many subjects does it take to do a regression analysis?
Multivariate Behavioral Research, 26(3), 499-510.
doi:10.1207/s15327906mbr2603_7

Hunt, R. (2018). *Bentonville west high school comprehensive progress report*.
Bentonville, Arkansas: Retrieved from
https://www.bentonvillek12.org/cms/lib/ar02203372/Centricity/Domain/4520/BW_HS_ComprehensiveReport.pdf

Kamanetz, A. (2018, April 29). *What "A nation at risk" got wrong, and right, about U.S. schools*. Retrieved from <https://www.npr.org/sections/ed/2018/04/29/604986823/what-a-nation-at-risk-got-wrong-and-right-about-u-s-schools>

- Klein, A. (2015). No child left behind: An overview. *Education Week*. Retrieved from <https://www.edweek.org/ew/section/multimedia/no-child-left-behind-overview-definition-summary.html>
- Lee, A. M. I. (2019) *Every student succeeds act (ESSA): What you need to know*. Retrieved from <https://www.understood.org/en/school-learning/your-childs-rights/basics-about-childs-rights/every-student-succeeds-act-essa-what-you-need-to-know>
- Lindsay, S. (2015). *The history of the ACT test*. Retrieved from <https://blog.prepscholar.com/the-history-of-the-act-test>
- Lindsay, S. (2018). *How many AP classes do you need for Ivy League schools?* Retrieved from <https://blog.prepscholar.com/how-many-ap-classes-do-you-need-for-ivy-league-schools>
- Madaus, G. F., & Stufflebeam, D. L. (1984). Educational evaluation and accountability: A review of quality assurance efforts. *American Behavioral Scientist*, 27(5), 649-672. doi:10.1177/000276484027005007
- Mattern, K., Radunzel, J., & Harmston, M. (2016). ACT composite score by family income. *ACT Research and Policy*. Retrieved from <https://www.act.org/content/dam/act/unsecured/documents/R1604-ACT-Composite-Score-by-Family-Income.pdf>
- Miron, W. S. (2008). *Effect on student achievement of relaxing admission criteria into advanced placement courses at an affluent suburban high school*. Retrieved from

<https://scholarship.shu.edu/cgi/viewcontent.cgi?article=1385&context=dissertations>

Minarechová, M. (2012). Negative impacts of high-stakes testing. *Journal of Pedagogy; Warsaw*, 3(1), 82-100. doi:10.2478/v10159-012-0004-x

National Center for Education Statistics. (2019). *Fast Facts*. Retrieved from <https://nces.ed.gov/fastfacts/display.asp?id=40>

Ogee, A., Ellis, M., Scibilia, B., Pammer, C. & Steele, C. (2013). *Multiple regression analysis: Use adjusted R-squared and predicted R-squared to include the correct number of variables*. Retrieved from <https://blog.minitab.com/blog/adventures-in-statistics-2/multiple-regression-analysis-use-adjusted-r-squared-and-predicted-r-squared-to-include-the-correct-number-of-variables>

Pai, Y., & Adler, S. A. (2001). *Cultural foundations of education* (3rd ed.). Upper Saddle River, NJ: Merrill/Prentice Hall.

The Princeton Review. *What is the ACT?* (2019). Retrieved from <https://www.princetonreview.com/college/act-information>

Pritchett, A. (2018). *The ACT*. Retrieved from www.arkansased.gov/divisions/learning-services/assessment/the-act

ProCon.org. *History of standardized tests*. (2018). Retrieved from <https://standardizedtests.procon.org/view.resource.php?resourceID=006521>

- Ravitch, D. (2002). A brief history of testing and accountability. *Hoover Digest*, (4), 9-21. Retrieved from <https://www.hoover.org/research/brief-history-testing-and-accountability>
- Salkind, N. J. (2017). *Statistics for people who (think they) hate statistics* (6th ed.). Thousand Oaks, CA: Sage.
- Santoli, S. P. (2002). Is there an advanced placement advantage? *American Secondary Education*, 30(3), 23. Retrieved from <https://eric.ed.gov/?id=EJ651963>
- Samuels, A. (2017). Poor girls are leaving their brothers behind. *The Atlantic*. Retrieved from <https://www.theatlantic.com/business/archive/2017/11/gender-education-gap/546677/>
- Statistics How To. (2015). *Parsimonious model: Definition, ways to compare models*. Retrieved from <https://www.statisticshowto.datasciencecentral.com/parsimonious-model/>
- Strauss, V. (2018). 'A nation at risk' demanded education reform 35 years ago. Here's how it's been bungled ever since. Retrieved from https://www.washingtonpost.com/news/answer-sheet/wp/2018/04/26/the-landmark-a-nation-at-risk-called-for-education-reform-35-years-ago-heres-how-it-was-bungled/?noredirect=on&utm_term=.a91ea184ec7a
- Thibodeaux, A. K., Labat, M. B., Lee, D. E., & Labat, C. A. (2015). The effects of leadership and high-stakes testing on teacher retention. *Academy of Educational Leadership Journal*, 19(1), 227-249. Retrieved from <https://www.abacademies.org/articles/aeljvol19no12015.pdf>

United States National Commission on Excellence in Education. (1983). *A nation at risk: The imperative for education reform*. Washington, DC: The National Commission on Excellence in Education.

University of Arkansas. (n.d.). *Undergraduate admissions*. Retrieved from <https://admissions.uark.edu/apply/prepcore.php>

Vanderstraeten, R. (2003). Education and the condicio socialis: Double contingency in interaction. *Educational Theory*, 53(1), 19-35. doi:10.1111/j.1741-5446.2003.00019

Warne, R. T. (2015). Pushing students to take advanced placement courses does not help anyone. Retrieved from <http://theconversation.com/pushing-students-to-take-advanced-placement-courses-does-not-help-anyone-45350>

Warne, R., Larsen, R., Anderson, B., & Odasso, A. (2015). The impact of participation in the advanced placement program on students' college admissions test scores. *Journal of Educational Research*, 108(5), 400-415. doi:10.1080/00220671.2014.917253

Wignall, A. (2019). *Preference of ACT or SAT by state* [Infographic]. College Raptor. Retrieved from <https://www.collegeraptor.com/getting-in/articles/act-sat/preference-act-sat-state-infographic/>

Wodiska, J. (2018). *Every student succeeds act: Information and resources*. Retrieved from <http://www.ncsl.org/ncsl-in-dc/standing-committees/education/every-student-succeeds-act-essa-information-and-resources.aspx>

Worsham, H. (2018). *Act aspire*. Retrieved from

www.arkansased.gov/divisions/learning-services/assessment/act-aspire

Young, J. W. (2003). The past, present, and future of the SAT: Implications for college

admissions. *College and University*, 78(3), 21-24. Retrieved from

[https://www.aacrao.org/research-publications/quarterly-journals/college-](https://www.aacrao.org/research-publications/quarterly-journals/college-university-journal/article/c-u-archive/c-u-vol.-78-no.-3-winter-2003-(.pdf))

[university-journal/article/c-u-archive/c-u-vol.-78-no.-3-winter-2003-\(.pdf\)](https://www.aacrao.org/research-publications/quarterly-journals/college-university-journal/article/c-u-archive/c-u-vol.-78-no.-3-winter-2003-(.pdf))

Appendices

Appendix A:

Table A1

Values from the Predictive Equations in Table 4

ACT Score	Regression	Residual	F value	<i>p</i> value	Adj R ²
English	3	288	194.066	0.000	0.772
Reading	2	289	282.885	0.000	0.66
Math	3	288	271.082	0.000	0.736
Science	2	289	268.466	0.000	0.648
Composite	3	288	428.391	0.000	0.815

Appendix B: Permission Letter from ATU IRB



ARKANSAS TECH
UNIVERSITY

**Office of Sponsored Programs
and University Initiatives**
Administration Building, Room 207
1509 North Boulder Avenue
Russellville, Arkansas 72801

Office: 479-880-4327
www.atu.edu

September 4, 2019

To Whom It May Concern:

The Arkansas Tech University Institutional Review Board Chair has deemed the IRB application for Jonathon Guthrie's proposed research, entitled "Predictive Ability of Choosing Advanced Placement Courses on ACT Scores of Secondary Students" to be exempt under category 4. Research activities in which the only involvement of human subjects will be in one of more of the exempt categories defined by the federal regulations are given an exempt determination rather than IRB approval. Thus, no IRB approval number has been assigned to this study. The Chair approves for the researcher(s) to proceed with the study.

Please note that, in the event that any of the parameters of the study change, the researcher may be required to submit an amended IRB application.

Sincerely,

Gabriel L. Adkins, Ph.D.
Institutional Review Board Chair
Arkansas Tech University

Appendix C: Permission from School District for Access to Data

4201 SW Banbury Drive
Bentonville, AR 72713
August 20, 2019

Dr. Debbie Jones
Superintendent of Bentonville Schools
500 Tiger Boulevard
Bentonville, AR 72712

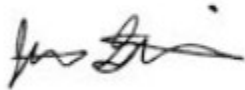
Dr. Jones,

I am writing to request permission to use data from the BWHS class of 2019 for my doctoral dissertation study. I am completing my dissertation as part of my doctoral program at Arkansas Tech University. The goal of my study is to identify predictors of ACT scores, with a focus on the completion of advanced courses.

I look forward to using the data to help students, staff, and parents make informed choices when selecting courses. All student names and identifiable data will remain confidential, and be removed from the data before any results are published. The data I will need includes students' gender, SES, classes taken, ACT Aspire scores, and ACT scores.

Please sign below if you approve of my use of the requested data. Please let me know if you have any questions.

Thank you very much.



Jonathon Guthrie

Please sign below if you approve of the data use:

Signature: Debbie Jones

Date: 8-21-19