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The Correlation Between the ACT, Inc. EXPLORE Test and Student Success in High School Advanced and Advanced Placement Mathematics Courses

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The Correlation Between the ACT, Inc. EXPLORE Test and Student Success in High School Advanced and Advanced Placement Mathematics Courses

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by

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ABSTRACT

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The purpose of this study was to compare the relationship between the mathematics portion of the EXPLORE test with students successes in advanced and Advanced Placement(AP) mathematics courses in high school. The data was collected from a rural Tennessee school system consisting of five years of data among graduated seniors. Analysis was completed to determine the difference between the two county high schools in advanced coursework. The findings of this study concluded a positive correlation between EXPLORE scores and the frequency of students who took advanced mathematics courses. Positive correlation between EXPLORE scores and student successes in advanced courses was also concluded. Two-sample t-test showed the school with the less frequency had a higher mean of successes in advanced mathematics. This school system consistently scored above the national average in the mathematics portion of the EXPLORE test. Ultimately, standardized test results can prove to be a means for guiding students toward challenging mathematics courses.

DEDICATION

I am thankful for my faith and hope in our Lord Jesus Christ. I dedicate this accomplishment to my family, whom without their love and support, would not have been possible.

To my best friend and love of my life, my husband Jeffrey Story, who managed to take care of EVERYTHING while working two jobs. You have encouraged, loved, spoiled and taken care of me, not only through this grueling process, but from our very first date. This would not have been possible without you. I am looking forward to making up for all the lost hours with you.

To my father, God Rest His Soul, who taught me the meaning of patience, perseverance and unfailing love. He made me promise him I would finish my degree, no matter what happens in life, never give up. To my mother, who taught me to believe in myself and the God given abilities I was blessed with. She never fails to listen to all my joys and worries life throws my way. She is my light in dark places.

To my children: Bradley Parks, Nathan Parks, Elaina Wetz and Richard Parks. I am very proud of the adults you have become; I love you all with all my heart. I want to give a special thank you to my daughter who edited many of my grammatical deficiencies from the other side of the world while proudly serving in the United States Air Force. Her quality education shines like a beacon. I cannot thank you enough sweetheart.

Last but not least, my siblings, extended family and all my near and dear friends and colleagues that have encouraged me along the way. I have a wonderful support system and I thank you all!

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To the school system of this study, I thank you for allowing me to pursue my research using your students' data. I hope my findings prove informational and can be used to benefit the students of your district or spark an interest for further research.

To Dr. Crystal Davis, I thank you for taking the time out of your busy schedule to give me constructive feedback on my research. I am grateful for my step-daughter Argelin Story for being concerned enough for me to call you for assistance. I extend my gratitude to the both of you.

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1 INTRODUCTION

1.1 *Statement of the Problem*

There is a plethora of information to guide students' educational learning processes through standardized testing, whether it is state mandated or grade level appropriate national tests. The proper use of student data and maximizing the information it provides remains a current issue throughout education. Administrators across the country critically assess their students' test data and use the results to their greatest extent. The subject of this study, an east Tennessee school system, is no exception.

This school system is split into two approximately equal sides of a rural county. It is comprised of ten elementary/middle schools that feed into the two high schools. Although the high schools are similar in size with just over 1200 students in each, their demographics are very different. According to the Tennessee State Report Card, High School A has nearly 10% more economically disadvantaged students, three times the English learners, 3% more students with disabilities, twice as many students in foster care and nearly five times the number of homeless students than High School B.

Educators of this school system use data to drive their instruction through differentiation, grouping and more; making a plan of action for the twenty-five to thirty-five students who are placed in their classes. Their students' skills can often vary from a third grade mathematics skill level to above grade level skills within the same class. This can be very challenging and stressful for mathematics educators as well as proving detrimental to students. The students above grade level could get bored or not

gain the knowledge to their fullest potential. Furthermore, students lacking grade level skills could get frustrated feeling overwhelmed and hopeless to which they give up, leading to a series of repeated courses.

This study will touch upon one aspect of the data supplied from the mathematics portion of a particular nationally offered test. The national standardized test to measure academic knowledge, which many students take in eighth grade, is based on standards aligned to track their preparedness for college or professional careers upon graduation from high school. Ensuring proper placement could propel students toward their academic goals.

The general problem is the proper placement of students into ninth grade Advanced Algebra I, in fact many students who scored well on their EXPLORE test never took an advanced course until an AP course. The specific problem is the uncertainty of whether there is enough evidence to use the mathematics standardized tests results in the eighth grade as the only means of proper student placement in ninth grade mathematics courses. More importantly, answering whether the likelihood of students being successful in advanced courses can be predicted by those test scores. Therefore, the question arises, could these test results be used as a tool to group students in their Algebra I course according to their skill level, challenging them to their fullest potential?

1.2 *Research Questions*

The following research questions guided this study:

1.) Is there a significant correlation between eighth grade EXPLORE scores in

mathematics and the number of students who took at least one advanced and/or AP mathematics course?

2.) Is there a significant correlation between eighth grade EXPLORE scores in mathematics and the number of students who had *successes* in one, two or many advanced and/or AP mathematics course(s) respectively?

3.) Is there a significant difference between the two high schools in the frequency of students taking advanced and/or AP mathematics courses?

4.) Is there a significant difference in the mean number of student *successes* in advanced and/or AP mathematics courses between the two high schools?

5.) How well did the students' EXPLORE score in mathematics, within this rural community, compare to the national average?

1.3 *Significance of the Study*

This study will use high school students' mathematics standardized test scores and compare them to the students' success in advanced and Advanced Placement (AP) mathematics courses in high school. Determining a correlation between the mathematics test scores and students' success in advanced coursework could prove to be a means for guiding students toward enrollment into more challenging mathematics courses in order to maximize their educational potential.

1.4 *Definition of Terms*

grades: the grades used in the study have been modified to a 4.0 scale. A grade typically rated as an A resulting in 93-100% has been modified to a 4, a grade rated

as a B resulting in 85-92% has been modified to a 3, a grade rated as a C resulting in 75-84% has been modified to a 2, a grade rated as a D resulting in 70-74% has been modified to a 1, and a grade rated as an F resulting in 0-69% has been modified to a 0.

rigor: unyielding learning standards and educational expectations that are academically, intellectually, and personally challenging with depth in critical thinking.[1]

success in a course: success in this study will be defined as earning an A or a B in advanced and/or AP Mathematics coursework. A grade of C is considered average and is not deemed successful in these types of courses. ACT defines success in high school core courses as an earned grade of B or higher.[2]

upper level courses: Courses above the core mathematics courses of Algebra 1, Geometry and Algebra II.

KEY NOTE- All grades recorded are grades earned for the students' first attempt of the course.

1.5 *Delimitations and Limitations*

The population of this study was delimited to students in a rural East Tennessee school system who took the EXPLORE test during their eighth grade year, and then followed their enrollment in high school mathematics until graduation. Results may not be generalized to any other rural high schools. Limitations of this study include the validity and reliability of the EXPLORE test, and of any teacher inconsistencies on grading techniques.

2 LITERATURE REVIEW

2.1 *Standardized Testing*

The development of standardized tests did not come from the education realm; rather it was a way for the Department of the Army to develop rapid screening of intellectual abilities for selection to their officer training program during the First World War. This assessment was known as the Army Alpha Test.[3] As the debate on educational equality arose, so did the benefits of standardized testing. Recently teachers have used standardized test scores, and the break down analysis, to implement an intervention plan for their students. The goal of this plan was to fill education gaps in their learning, especially in mathematics where conceptual topics build off of prior knowledge. For example, teachers cannot expect students to understand how to multiply polynomials if they do not have a solid understanding of the properties of multiplication. This can raise the question of the benefits of standardized results. From the psychological perspective of Benjamin and Pashler, "Tests encourage the kind of thinking that is essential not just for retention but also for mentally organizing the acquisition of new material." [4, p. 17]

The vital analysis derived from standardized tests can inform the teacher what topics are important and where the students are mathematically deficient. Benjamin and Pashler go on to say, "One of the reasons that tests are unappealing to some students and to their parents is that tests fairly reveal what we do and do not know."[4, p. 18] Standardized testing can be used to enhance education, not just measure it.

Every state strives to better their educational process. The State of California

went into great detail when they passed Senate Bill 359, The California Mathematics Placement Act of 2015 [5], which state the following:

> (a) Pupil achievement in mathematics is important to prepare pupils for college and their future careers, especially those careers in the fields of science, technology, engineering, and mathematics (STEM).
>
> (b) Placement in appropriate mathematics courses is critically important for a pupil during his or her middle and high school years. A pupil's 9th grade math course placement is a crucial crossroads for his or her future educational success. Misplacement in the sequence of mathematics courses creates a number of barriers and results in pupils being less competitive for college admissions, including admissions at the California State University and University of California.
>
> (c) The most egregious examples of mathematics misplacement occur with successful pupils and, disproportionately, with successful pupils of color. These successful pupils are achieving a grade of "B" or better, or are testing at proficient or even advanced proficiency on state assessments. Nevertheless, they are held back to repeat 8th grade mathematics coursework rather than advancing to the next course in the recommended mathematics course sequence.
>
> (d) Mathematics misplacement has far-reaching impacts on a pupil's confidence, general knowledge of mathematical concepts, and high school experience, and may also impact the college career opportunities available

to the pupil.

Tennessee Department of Education's Course Placement Series *Spotlight on Eighth Grade Algebra I* explored course enrollment policies and procedures focusing on students taking Algebra I in the eighth grade.[6] This study concluded that taking Algebra I in the eighth grade would allow for students to enroll in more advanced coursework throughout high school. The resultant of hard work and the rigor of more advanced coursework can lead students towards majoring in the demanding fields of Science, Technology, Engineering or Mathematics (STEM) degree programs.

The study showed, of the top third of students from the Tennessee Comprehensive Assessment Program (TCAP), those students who took Algebra I in the eighth grade scored nearly three points higher on the ACT than those who took standard eighth grade math. Therefore, encouraging students who score advanced on their seventh grade TCAP to take Algebra I in the eighth grade could propel them on a higher path of college preparedness. However, Tennessee's research revealed an alarming fact stating: "Almost all of the top third of students on seventh grade math TCAP scores pass the Algebra I End of Course exam regardless of when they take Algebra I. Yet, less than half of students who are 'Algebra I Ready' at the end of seventh grade are enrolled in Algebra I in eighth grade." [6, p. 2]

2.2 *History of ACT and EXPLORE*

Education has put an increased emphasis on college readiness for high school students. ACT, Inc. has been one of the leading organizations in the assessment of student readiness for college coursework since 1959. This non-profit organization fo-

cuses on student achievement and mastery of skills. Through continual research, ACT strives to improve the assessment of students in their college and career readiness; examples of this include research such as: *Crisis at the Core*[7], *Reading Between the Lines*[8], and *Rigor at Risk*[9] continues to raise the bar in student assessment.

Since the 1990's, ACT's Educational Planning and Assessment System (EPAS) has assessed student achievement with benchmark standards at various grade levels to measure achievement in English, mathematics, science and reading. EPAS is an integrated series of assessments and career planning programs consisting of three tests between the eighth and twelfth grades. The first test in this system is the EXPLORE® test given to students in the eighth or ninth grade, followed by the PLAN® test in the tenth grade and then the ACT® in the eleventh or twelfth grade.

The College Readiness Standards applied to the EPAS serves as a connection between acquired academic knowledge and what the student must learn before graduating from high school. The College Readiness Standards set benchmarks to monitor student achievement by applying the scores as an indicator of the students' likelihood of succeeding in college. College Readiness Benchmark Scores for the ACT represent median test scores that are predictive of student success in relevant college courses.[2] The EXPLORE's primary purpose was to test the abilities of students in the eighth and ninth grade in the subjects of English, mathematics, reading and science. Each subject is further broken down into content sub categories.

Math, for example, is broken down into four subsets: Pre-Algebra, Elementary Algebra, Geometry and Statistics/Probability.[10] If students score well in the Pre-

Algebra and Elementary Algebra subsets but scored low in the Geometry subset, the students could be lacking in spatial skills. The test results were developed to aid students' career paths and course selections as they continue their education. The test score results are also used to predict the students' scores on the next test in EPAS.

The EXPLORE test became nationally known through ACT Inc. staggering research *The Forgotten Middle*, which examined specific factors that influence college and career readiness.[11] *The Forgotten Middle* study found that if a student is not academically ready, according to College Readiness Standards, by the time students complete the eighth grade the impact may be nearly irreversible. The research states: "... under current conditions, the level of academic achievement that students attain by eighth grade has a larger impact on their college and career readiness by the time they graduate from high school than anything that happens academically in high school."[11, p. 2]

Each content area assessed on the EXPLORE test is listed in six score ranges amongst a scale common to all three tests in the EPAS: EXPLORE (1–25), PLAN (1–32), and ACT (1–36). This common scale, regardless of the test, ensures skills associated with each range are identical and increases in complexity relevant to grade level tested. Therefore, the 26-32 score range is specific to the PLAN and the 33-36 score range is specific to ACT only.[2] The scale scores received reveals whether students are on track for success in college. Many school systems, such as the one in this study, use the students' eighth grade Mathematics EXPLORE scores as one of the deciding factors in the appropriate placement in ninth grade Algebra I classes.

The extreme high scores and the extreme low scores are easier to place in either an Advanced Algebra I course or a yearlong block Algebra I course. The students who ranked in the mid-range are left with the uncertainty as to the type of class they are best suited for, and how that placement will be determined.

2.3 *EXPLORE Results-What Does it Show*

The EXPLORE results are considered to be an early indication of the likelihood students are academically ready for college entry level courses. These results show the students where they are in comparison to the benchmark scores. Students who are at, or above, the College Readiness Benchmark Scores for the mathematics portion of the test indicates that with continued hard work and challenging coursework, they are on the right path toward success in an entry level college mathematics course. Along with the students' EXPLORE test scores, they are supplied with a recommended college readiness action plan, which suggests coursework they should take in high school to improve their academic skills and preparedness for college.

There are many factors that can affect students test results. Removing the complacency students develop toward standardized testing is a major factor in performance scores. In recent years, there has been a shift in the Tennessee state standardized testing model leaving many tests invalid or meaningless in the calculation of students' academic grades. This inconsistency has left students with the mindset of "why try if it doesn't count." Unfortunately, this attitude has trickled into the EPAS, with the exception of preparing for college with the ACT. Many students do not see the need (or benefit) of doing well on the EXPLORE or PLAN test.

The EXPLORE academic assessment program creates various reports for the students, teachers, and the school system as a whole through interpretive results. The Profile Summary Report provided to the school system addresses issues common among schools with valuable information. This report allows the school system to draw conclusions about current policies, programs and current educational practices. Along with social and economical factors, this report can be used by the school to aid in appropriate decision making to improve students' educational success through timely intervention.

Many critics wonder if standardized test results are an accurate indicator of students' knowledge. The ideal standardized test that can completely measure students' knowledge has not been created. However, standardized tests used for college entrance, such as the ACT or SAT, provide colleges with relatively objective data allowing them to compare prospective students. These tests are like an equalizing force that places all students on the same playing field.

2.4 *Advanced and Advanced Placement Coursework*

High school advanced coursework is designed to challenge students with a deeper understanding of the topic being presented, emphasizing academic rigor. Students who have aspirations of going to college and are willing to be challenged to their academic potential should consider taking advanced coursework. According to ACT's research *Rigor at Risk*, the United States educational system is lacking rigor in the core classes needed to succeed post graduation.[9] Some students turn to advanced coursework to heighten the rigor in a desired subject area. Students who have set

their sights on college often turn to the AP courses in hopes of getting a head start on college credits.

Advanced Placement (AP) coursework delves deeper into subjects that students find interesting and/or challenging. In addition to the rigorous coursework, many students learn additional skills needed to succeed in college, such as time management, efficient note taking and study habits. Taking AP courses demonstrates to potential colleges that students are taking their education seriously and are willing to take rigorous courses to challenge their potential.

Advanced Placement (AP) tests are scored on a scale of 1-5. According to AP Central, "Research shows that students who receive a score of 3 or higher on AP Exams typically experience greater academic success in college and have higher graduation rates than their non-AP peers."[12] Many colleges and universities accept a score of 3 or higher on the AP test, giving students college credit in an equivalent college level course.

3 RESEARCH METHODOLOGY

3.1 *Methodology*

Research methodology is the key to determining the results to unknown questions. The purpose of this study was to determine the correlation (if any) between eighth grade EXPLORE scale scores and students' successes in advanced and AP mathematics courses. The study required quantitative research methods to analyze similarities and differences ultimately determining relationships between the given variables. The quantitative methods included Pearson linear correlations, frequency distribution, two-sample t-test and statistical data analysis.

3.2 *Research Questions and Null Hypotheses*

This study used the following research questions with each null hypotheses relating to EXPLORE scores and student success in one or more advanced and/or AP mathematics course(s):

1.) Is there significant correlation between eighth grades EXPLORE scores in mathematics and the number of students who took at least one advanced and/or AP mathematics course?

H01: There is not a significant correlation between eighth grade EXPLORE scores in mathematics and number of students who took at least one advanced and/or AP mathematics course.

Ha1: There is a significant correlation between eighth grade EXPLORE scores in mathematics and number of students who took at least one advanced and/or AP

mathematics course.

2.) Is there a significant correlation between eighth grade EXPLORE scores in mathematics and the number of students who had *successes* in one, two or many advanced and/or AP mathematics course(s) respectively?

H02: There is not a significant correlation between eighth grade EXPLORE scores in mathematics and the number students who had *successes* in one, two or many advanced and/or AP mathematics course(s) respectively.

Ha2: There is a significant correlation between eighth grade EXPLORE scores in mathematics and the number students who had *successes* in one, two or many advanced and/or AP mathematics course(s) respectively.

3.) Is there a significant difference between the two high schools in the frequency of students taking advanced and/or AP mathematics courses?

H03: There is not a significant difference between the two high schools in the frequency of students taking advanced and/or AP mathematics courses.

Ha3: There is a significant difference between the two high schools in the frequency of students taking advanced and/or AP mathematics courses.

4.) Is there a significant difference in the mean number of student *successes* in advanced and/or AP mathematics courses between the two high schools?

H04: The mean number of student *successes* in advanced and/or AP mathematics courses between the two high schools are equal.

Ha4: The mean number of student *successes* in advanced and/or AP mathematics courses between the two high schools are not equal.

5.) How well did the students' EXPLORE score in mathematics, within this rural

community, compared to the national average?

H05: The students of this rural east Tennessee school system scored less than or equal to the national average.

Ha5: The students of this rural east Tennessee school system scored more than or equal to the national average.

3.3 *Population*

The sample set of this study consists of students in a rural East Tennessee school system. It includes students who took the EXPLORE test in the eighth grade and follows students until graduation within this same school system. For the purpose of this study, students who did not take the EXPLORE test in this particular school system, yet graduated from this system, were removed from the data set. Furthermore, the students who took the EXPLORE test, but did not graduate from the school system, were also removed. Students from this rural northeast Tennessee school system came from ten middle schools and two high schools to include: 420 of the 626 graduates in 2018, 432 of the 712 graduates in 2017, 372 of the 634 graduates in 2016, 431 of the 601 graduates in 2015, and 426 of the 614 graduates in 2014.

3.4 *Data Collection*

The data collection and connective relations were done within the school system by employees in order to protect students' identities involved in this study. The data provided for this study included a randomized number to replace students' names as well as an unknown code for each of the two high schools and ten middle schools

within the school system. The set included five years' worth of data of graduated seniors from 2014 through 2018. The data included: year students graduated, students' EXPLORE scores, ACT scores, and whether the student took one or more of the following advanced mathematics courses and with his/ her grade in each course. The courses included Algebra I Advanced, Geometry Advanced, Algebra II Advanced, Advanced Algebra and Trigonometry, AP Statistics, Advanced Calculus, AP Calculus.

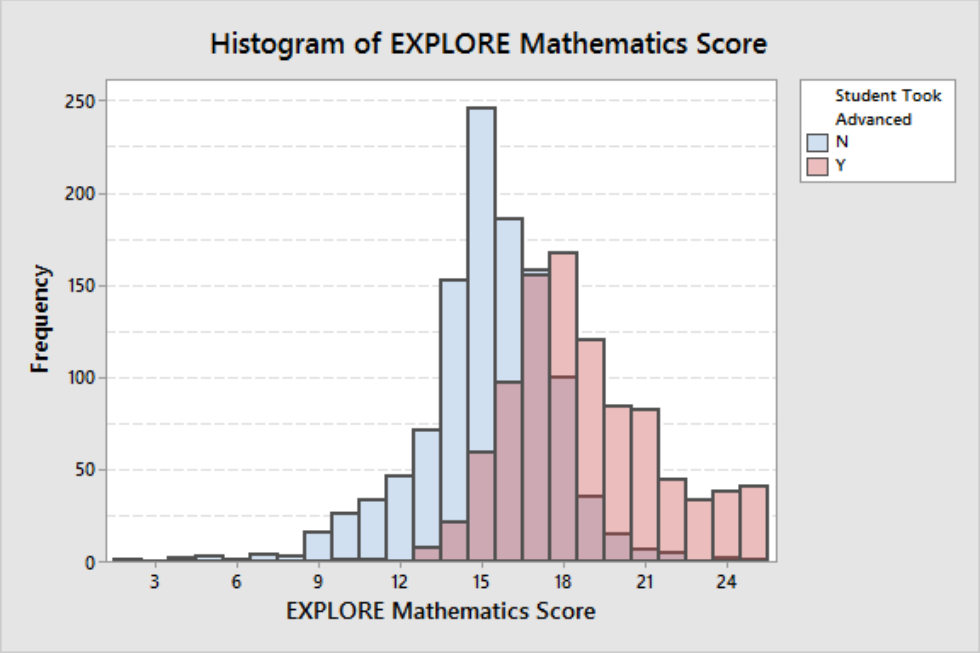
3.5 *Data Analysis*

Data analysis was conducted with the assistance of programs including Microsoft Excel version 2007, Google Sheets and the statistical program Minitab 18. This research conducted a series of Pearson correlations between EXPLORE mathematics scale scores and student success in one or more advanced and/or AP mathematics course(s). The Pearson correlation coefficient has the following recommended (but not limited to) strength guidelines: 0.50-1.00 strong, 0.30-0.50 moderate, 0.00-0.30 weak. In order to measure whether or not students were successful within a particular advanced or AP course(s), the students' mathematics course grades were applied. A two sample t-test was used to compare the mean number of successes in advanced and/or AP mathematics courses per high school. A data analysis of the EXPLORE mathematics scale scores was used to compare the rural east Tennessee school system to the national average. All data was calculated with a 0.05 significance level.

4 SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The following research analyzed student performance on the mathematics component of the EXPLORE test with their success(es) in an advanced and/or AP mathematics course(s). Figure 1 depicts the entire data set displaying the non-advanced and advanced students in comparison to their EXPLORE score. The following questions were answered in this research.

Figure 1: *Histogram of Non Advanced vs Advanced and EXPLORE scores*



4.1 *Research Question 1*

Is there significant correlation between the eighth grades EXPLORE scores in mathematics and the number of students who took at least one advanced and/or AP mathematics course?

H01: There is not a significant correlation between eighth grade EXPLORE scores in mathematics and the number of students who took at least one advanced and/or AP mathematics course.

Ha1: There is a significant correlation between eighth grade EXPLORE scores in mathematics and the number of students who took at least one advanced and/or AP mathematics course.

Findings: R-value = 0.559 with a P-value = 0.000; Reject the null hypothesis.

Table 1: *Correlation: EXPLORE Mathematics Score and At Least One Advanced*

Correlation: EXPLORE Mathematics Score and At least One Advanced

Correlations (α = 0.05)

Pearson correlation	0.559
P-value	0.000

Conclusion: There is sufficient evidence to conclude there is a strong significant linear relationship between eighth grade EXPLORE mathematics scores and the number of students who took at least one advanced and/or AP mathematics course because the correlation coefficient is significantly different from zero.[Table 1]

4.2 *Research Question 2*

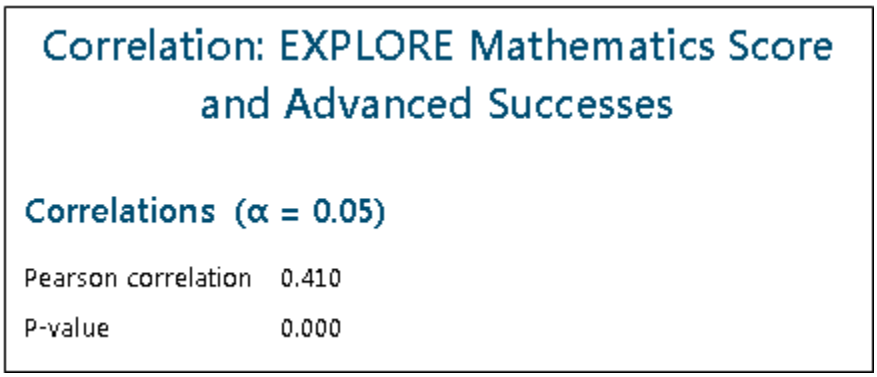
Is there a significant correlation between eighth grade EXPLORE scores in mathematics and the number students who had *successes* in one, two or many advanced and/or AP mathematics course(s) respectively?

H02: There is not a significant correlation between eighth grade EXPLORE scores in mathematics and the number students who had *successes* in one, two or many advanced and/or AP mathematics course(s) respectively.

Ha2: There is a significant correlation between eighth grade EXPLORE scores in mathematics and the number students who had *successes* in one, two or many advanced and/or AP mathematics course(s) respectively.

Findings: R-value = 0.410 with a P-value = 0.000; Reject the null hypothesis.

Table 2: *Correlation: EXPLORE Mathematics Score and Successes in Advanced*



Conclusion: There is sufficient evidence to conclude a significant linear relationship between eighth grade EXPLORE mathematics scores and the number of students success in either one, two or many advanced and/or AP mathematics course(s) respectively because the correlation coefficient is significantly different from zero.[Table 2]

4.3 *Research Question 3*

Is there a significant difference between the two high schools in the frequency of students taking advanced and/or AP mathematics courses?

H03: There is not a significant difference between the two high schools in the frequency of students taking advanced and/or AP mathematics courses.

Ha3: There is a significant difference between the two high schools in the frequency of students taking advanced and/or AP mathematics courses.

Findings: Reject the null hypothesis. High School B had nearly 36% more students who took an advanced and/or AP mathematics courses in comparison to High School A.[Figure 2]

Table 3: *Descriptive Statistics for Advanced Courses per High School*

Descriptive Statistics: Number of Advanced Mathematics Courses Students Took Per High School

Statistics

Variable	HS	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3
Advanced Mathematics	A	376	0	2.7420	0.0701	1.3584	1.0000	2.0000	3.0000	4.0000
	B	585	0	1.8479	0.0405	0.9805	1.0000	1.0000	2.0000	2.0000

Variable	HS	Maximum
Advanced Mathematics	A	6.0000
	B	5.0000

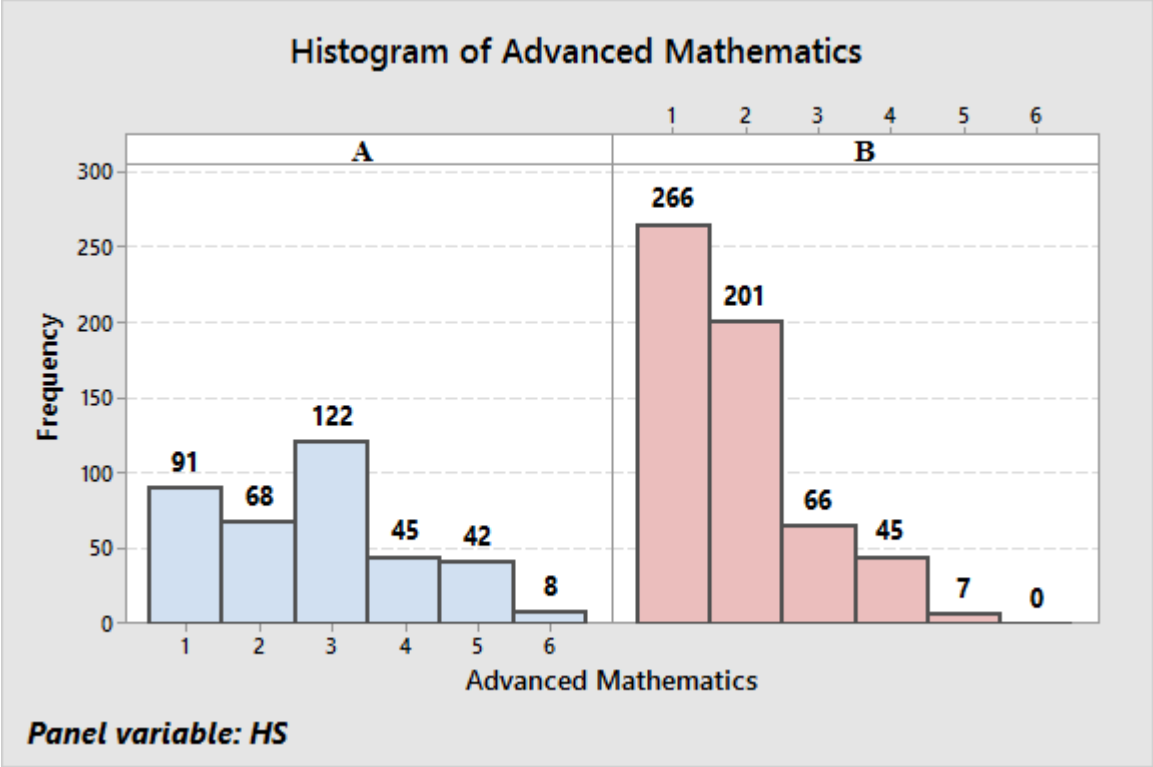
Conclusion: We can conclude with confidence, there is a significant difference between the two high schools in the frequency of students who take advanced and/or AP mathematics courses.[Table 3]

4.4 *Research Question 4*

Is there a significant difference in the mean number of student *successes* in advanced and/or AP mathematics courses between the two high schools?

H04: The mean number of student *successes* in advanced and/or AP mathematics

Figure 2: *Histogram of Advanced Mathematics per High School*



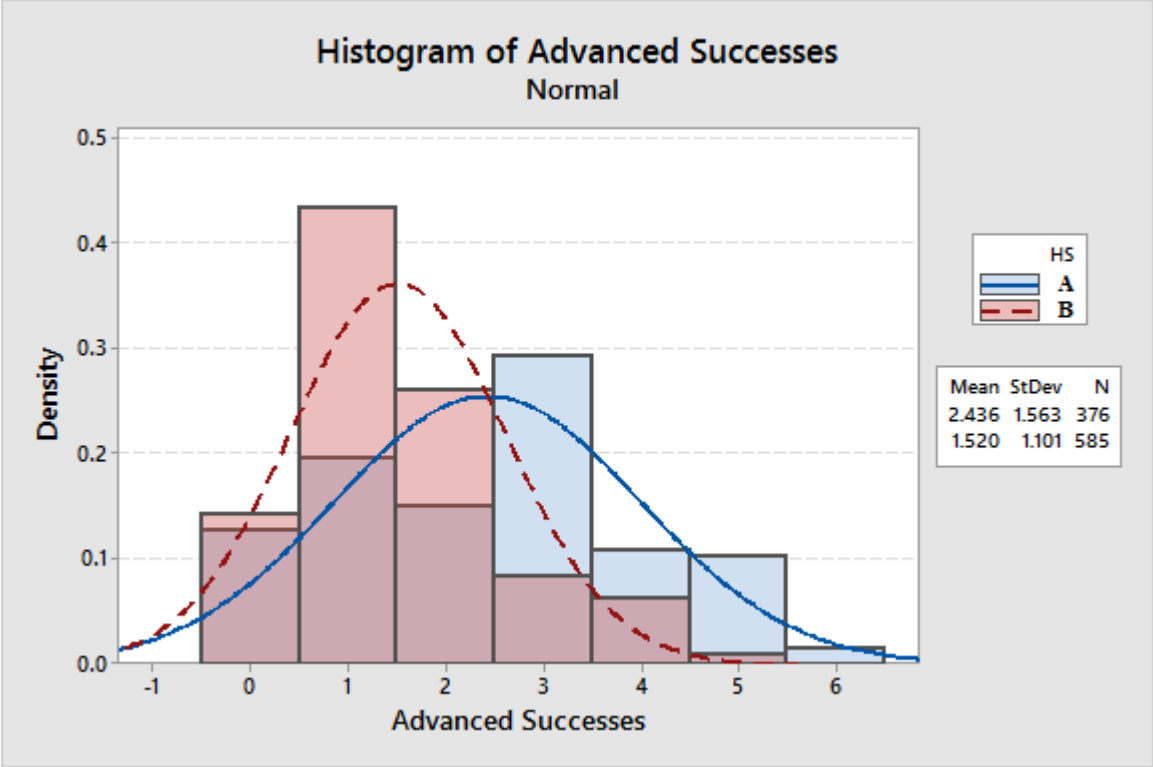
courses between the two high schools are eqaul.

Ha4: The mean number of student *successes* in advanced and/or AP mathematics courses between the two high schools are not eqaul.

Findings: Reject the null hypothesis. The mean number of successes in an advanced and/or AP mathematics course is significantly different with High School A having a mean success of 2.44 and High School B having a mean success of 1.52.[Table 4]

Conclusion: There is sufficient evidence to warrant rejection of the null hypothesis that the mean number of student *successes* in advanced and/or AP mathematics courses between the two high schools are eqaul.[Figure 3]

Figure 3: *Histogram of Advanced Mathematics Successes per High School*



4.5 *Research Question 5*

How well did the students' EXPLORE score in mathematics, within this rural community, compare to the national average?

H05: The students of this rural east Tennessee school system scored less than or equal to the national average.

Ha5: The students of this rural east Tennessee school system scored more than or equal to the national average.

Findings: Reject the null hypothesis. Each year within this study, students scored higher than the national average on the mathematics portion of the EXPLORE. [Table 5]

Table 4: *Two Sample t-test of Advanced Successes per High School*

Two-Sample T-Test and CI: Advanced Successes, HS

Method

μ1 mean of Advanced Successes when HS = A
μ2 mean of Advanced Successes when HS = B
Difference: μ1 - μ2

Equal variances are not assumed for this analysis.

Descriptive Statistics: Advanced Successes

HS	N	Mean	StDev	SE Mean
A	376	2.44	1.56	0.081
B	585	1.52	1.10	0.046

Estimation for Difference

Difference	95% CI for Difference
0.9165	(0.7347, 1.0983)

Test

Null hypothesis H0 μ1 - μ2 = 0
Alternative hypothesis H1 μ1 - μ2 ? 0

T-Value	DF	P-Value
9.90	612	0.000

The conclusion is as follows:

In the 2013-2014 school year, according to ACT's *Profile Summary Report*, the students scored on average higher than the national average in all areas of the EXPLORE test including 17.3 compared to the national average of 15.5 in mathematics. Amongst all eighth graders in this school system, 58% of the students reached the benchmark for college and career readiness. The 2018 graduates used in this study scored an average of 16.9 on the mathematics portion of the EXPLORE, which is also above the 15.5 national average.

In the 2012-2013 school year, according to ACT's *Profile Summary Report*, the students scored on average higher than the national average in all areas of the EX-

Table 5: *Student Numbers and National EXPLORE Averages*

Sample Number of Students, System EXPLORE Mathematics Scores and *National EXPLORE Mathematics Averages*

STUDENTS FROM HS A	205	212	193	225	206	1041
STUDENTS FROM HS B	215	220	179	206	220	1040
TOTAL STUDENTS SAMPLE	**420**	**432**	**372**	**431**	**426**	**2081**
STUDENTS FROM HS A	16.6	16.4	17.2	16.3	15.9	16.48
STUDENTS FROM HS B	17.2	17.3	17.5	16.9	17.1	17.2
SAMPLE AVG EXPLORE MATH SCORE	**16.9**	**16.9**	**17.4**	**16.6**	**16.5**	**16.86**
The National Average	*15.5*	*15.5*	*15.5*	*15.1*	*15.1*	

PLORE test including 16.8 compared to the national average of 15.5 in mathematics. Amongst all eighth graders in this school system, 52% of the students reached the benchmark for college and career readiness. The 2017 graduates used in this study scored an average of 16.9 on the mathematics portion of the EXPLORE, which is also above the 15.5 national average.

In the 2011-2012 school year, according to ACT's *Profile Summary Report*, the students scored on average higher than the national average in all areas of the EXPLORE test including 17.1 compared to the national average of 15.5 in Mathematics. Amongst all eighth graders in this school system, 54% of the students reached the benchmark for college and career readiness. The 2016 graduates used in this study scored an average of 17.4 on the mathematics portion of the EXPLORE, which is also above the 15.5 national average.

In the 2010-2011 school year, according to ACT's *Profile Summary Report*, the students scored on average higher than the national average in all areas of the EXPLORE test including 16.5 compared to the national average of 15.1 in mathematics. Amongst all eighth graders in this school system 47% of the students reached the

benchmark for college and career readiness. The 2015 graduates used in this study scored an average of 16.6 on the mathematics portion of the EXPLORE, which is also above the 15.1 national average.

In the 2009-2010 school year, according to ACT's *Profile Summary Report*, the students scored on average higher than the national average in all areas of the EXPLORE test including 16.3 compared to the national average of 15.1 in mathematics. Amongst all eighth graders in this school system, 50% of the students reached the benchmark for college and career readiness. The 2014 graduates used in this study scored an average of 16.5 on the mathematics portion of the EXPLORE, which is also above the 15.1 national average.

4.6 *Recommendation for Future Research*

These tests remained an educational standard until a new system was implemented in 2014, replacing both the EXPLORE with the Aspire test, and PLAN with the Pre-ACT, respectively. All five years of data in this study followed students who were participants of the old EPAS using their EXPLORE score results. It is suggested to further this research by comparing student success with the new EPAS system data results from the Aspire test continuing the placement and *success* of students in advanced and AP mathematics courses. It is also recommended to compare results with any changes the school system implements with regards to placement into ninth grade Advanced Algebra I.

4.7 *Summary*

The results of the EXPLORE standardized test provides a data set for student enrollment into more challenging and rigorous mathematics courses. Unfortunately, many students who master the EXPLORE mathematics component fail to be enrolled in these challenging mathematics courses. As a result, students do not take full advantage of rigorous advanced and/or AP courses maximizing their education potential. One possible reason for this could be the lack of gain toward a student's overall Grade Point Average (GPA). The advanced courses in this school system are not weighted on a more rigorous scale which could play a factor in the student's hesitation in hurting their GPA. Many college scholarships depend greatly on the student's overall GPA.

Discovering a correlation between EXPLORE mathematics scores and the *successes* students have in advanced coursework could be deemed as encouraging to future students in challenging themselves to reach beyond what they think is possible. If the school system of this study decided to use students' EXPLORE scores as the means of placing students into Advanced Algebra I, my recommendation, with the knowledge gained from this research, is that all students who score an 18-25 on the mathematics component of EXPLORE be placed into an advanced mathematics course. These students display the highest probability of having *success* in Advanced Algebra I.

Research shows a vast difference in the number of students who took an advanced and/or AP mathematics course between the two high schools. Moreover, proving a difference in the mean number of successes between two economically different high

schools demonstrates to students of all economical backgrounds that educational success has no bounds with dedication and hard work. One theory behind this inequality could be the lack of options for an Algebra I course. Many students at High School B may have taken an Algebra I Advanced course because it was only a semester long course. This may have been the only way to double up on mathematics courses in order to have more opportunity to take additional upper level mathematics courses their junior and senior years.

The small town rural school system of this study has demonstrated their efforts toward better preparing their students to be college bound ready. Striving to improve rigor and exposing their students to more advanced coursework in mathematics is the first step toward college preparedness and success.

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