# MATHEMATICS STUDENT ACHIEVEMENT IN THE CONTEXT OF IDAHO'S ADVANCED OPPORTUNITIES INITIATIVE

by

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The following individuals read and discussed the thesis submitted by student Nichole K. Hall, and they evaluated her presentation and response to questions during the final oral examination. They found that the student passed the final oral examination.

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ABSTRACT

Mathematics coursework a student completes in high school often directly affects their subsequent post-secondary education and career opportunities. In recent years, in a push to prepare a larger number of students for post-secondary education and career opportunities in Idaho, state initiatives have focused on addressing mathematics preparation in the middle grade years to increase the number of students completing an advanced mathematics pathway in high school, including the Advanced Opportunities Initiative to support financial costs of advanced coursework. Starting 2011, each year of the initiative has seen annual increases in students participating in dual credit and Advanced Placement (AP) coursework. This study addresses the academic outcomes of school, district, and state efforts aimed at increasing mathematics achievement in Idaho by analyzing transcript and state assessment data for annual cohorts of students who completed Algebra I or higher in Grade 8. Outcome measures include Grade 10 state achievement test scores, continuation of advanced mathematics course pathways, and completion of dual credit and/or AP courses. Findings suggest inconsistent mathematics achievement for advanced students as they complete high school mathematics courses.

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| | |
|---|---|
| ANCOVA | Analysis of Covariance |
| ANOVA | Analysis of Variance |
| AP | Advanced Placement |
| CEP | Community Eligibility Provision |
| CLEP | College-Level Examination Program |
| CNP | Child Nutrition Programs |
| EL | English Learner |
| FFP | Fast Forward Program |
| FRL | Free or Reduced Lunch |
| IB | International Baccalaureate |
| ISAT | Idaho Standard Achievement Test |
| MAP | Mastery Advancement Program |
| MOU | Memorandum of Understanding |
| SES | Socio-Economic Status |
| USDA | United States Department of Agriculture |

# CHAPTER ONE: INTRODUCTION

A main objective of the education discipline has always been to ensure that students develop the skills and knowledge necessary to become productive and successful adults (Schiller & Muller, 2003). In many careers (e.g., science, business, engineering, and health sciences), success may require achieving a moderate to high level of proficiency in mathematics (Adelman, 2006), so that the mathematics courses a student completes in high school directly affects their subsequent post-secondary and career pathway (Schiller & Muller, 2003).

Currently, too few high school graduates in the United States are proficient enough in mathematics to be accepted into a post-secondary institution of their choice, let alone have the ability to complete the post-secondary coursework necessary for a bachelor’s degree to make them successful competitors, especially in scientific and technological fields (Business-High Education Forum, 2005). Because of this, federal and state policy-makers have focused on identifying the pathway of mathematics courses at the secondary level which is the most predictive of later success. Once identified, initiatives can be developed and put into place to ensure an increase in the number of students following college mathematics pathways (Schiller & Muller, 2003).

## Mathematics Achievement Predictors

Identifying the essential areas of mathematics content that will be predictive of student achievement and later success, while controlling for other factors such as intellectual ability, race, ethnicity, gender and family background, allows researchers to focus on learning more about the “why” of mathematics achievement. This in turn can suggest productive teaching and learning improvements for targeted content areas that can increase mathematics achievement (Siegler, Duncan, Davis-Kean, Duckworth, Claessens, Engel & Meichu, 2012).

In initial steps toward identifying mathematics content that increases student achievement, researchers have found high school graduates who demonstrate low achievement in algebra and geometry coursework are often not prepared for the rigors of the post-secondary coursework required for mathematics intensive fields (Schiller & Muller, 2003). Also, if a student takes the minimum mathematics requirements at the secondary level, this decision will have both short- and long-term effects on their career options (Burris, Heubert & Levin, 2004). For example, students who take Algebra I in Grade 8 more commonly take advanced mathematics courses later on in high school (Rickles, 2013; Schiller & Muller, 2003). The rigor of such accelerated coursework during a student’s middle school years is a major predictor of whether students complete a bachelor’s degree (Adelman, 2006). Proficiency on state or district level mathematics assessments, along with teacher recommendations, are part of the measurement mechanism most often used to identify those students who are placed on an accelerated pathway (Loveless, 2008; Rickles, 2013).

## Definitions

Since the phrase student achievement can indicate multiple dimensions of students’ academic success, such as absolute or relative performance on a state or district level assessment, letter grades, GPA, or course enrollment outcomes, it is important to clarify how terms and related definitions are operationalized in this study.

*Student/Mathematics Achievement*: Student achievement is obtained when students graduate high school with a level of mathematics proficiency that allows them to move into a career pathway or successfully complete a post-secondary degree or certificate.

*Proficiency*: A score on a state or district level assessment. Proficiency scores/levels on different tests may not be comparable based on factors such as content, depth of knowledge, and psychometric structures of the measures.

*Academic History*: Educational factors strongly related to future student achievement, such as GPA, letter grades in prior courses, and assessment scores.

*Secondary Mathematics Track or Pathway*: A sequenced mathematics course of study that begins in middle school or the first year of high school; a student's mathematics track depends partly on his/her plans after graduating from high school and partly on state graduation requirements. The more advanced mathematics courses a student completes, the more options he/she will have for career and/or post-secondary education.

## Background

With choosing methods to increase student achievement left to individual states and districts, educational policies and processes created by policy-makers vary (Schiller &Muller, 2003). One response to too few high school graduates being ready for college or career pursuits has been the standards movement of the past several decades. This movement has included mathematics experts and researchers who have worked to articulate standards for mathematics, which if mastered at each grade level, will allow students to meet the mathematics achievement levels required to be successful beyond high school. In response to the standards movement, most states have either adopted new standards or infused current standards with more rigor and coherence (Burris, Heubert & Levin, 2006). Many states have also responded by increasing the number of mathematics courses students must take to graduate (Schiller & Muller, 2003), as well as requiring that all students enroll in and pass an Algebra I or a comparable course prior to graduating (Gamoran & Hannigan, 2000).

Idaho responded to low levels of student achievement in a number of different ways. In 2010, Idaho began requiring students to take six credits of mathematics at the secondary level, to include Algebra I, Geometry, and the remaining two credits in a mathematics course of the student's choice. In 2014, Idaho code was updated with the requirement that two of the six mathematics credits earned in a student's high school career had to be "taken in the last year of high school in which the student intends to graduate (Idaho Code 08.02.03.105)." See Figure 1, Idaho Graduation Requirements: Mathematics Credits.

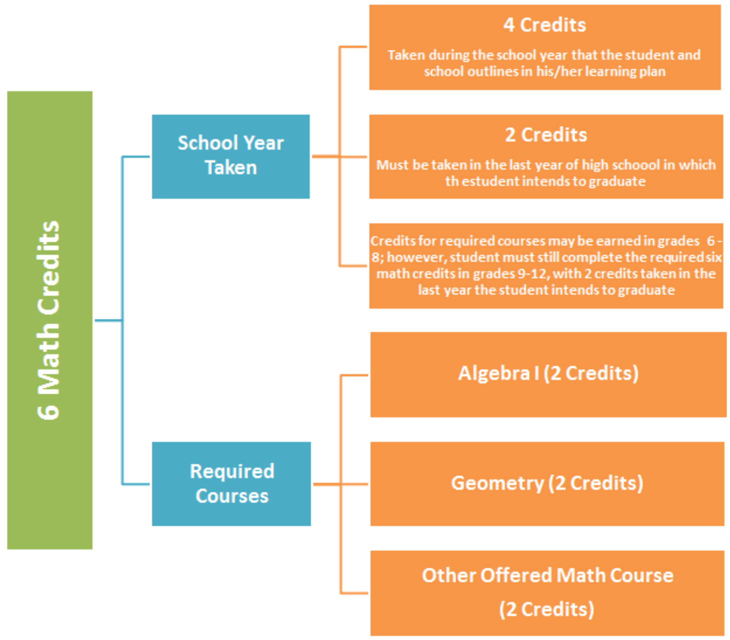


**Figure 1: Idaho Graduation Requirements - Mathematics Credits.**

Along with increasing graduation requirements, Idaho began funding several advanced opportunity programs with the intent to increase overall student achievement, as well as to increase the number of students taking advanced courses at the middle grade level (Algebra I in Grade 8), with the ultimate goal of relieving financial barriers and providing course choice for students; resulting in students having the opportunity to complete advanced mathematics courses in high school. This occurred in the context of three policy developments. The first occurred when the Idaho Senate Education Committee was asked to address a need for Idaho Legislation to fund overload courses in high school, a cost which previously fell on parents of Idaho students who take on extra courses in order to graduate early or take dual credit courses later on in their high school career. Concurrently, the Idaho Board of Education's Go-On Initiative was working to increase the number of students who go-on to enroll in a post-secondary institution within the first twelve months of graduating from high school, while the Idaho State Department of Education’s Student Comes First Initiative created the 8-in-6 program to allow secondary students to complete eight years of schooling in six years, by accelerating a student’s academic pathway so he/she could graduate high school with an associate’s degree.

Set within these developments has been a strong preference among Idaho policy makers for local control of education. Many local districts have always provided an accelerated pathway for some students. However, with the additional funding from the legislature, districts have been able to extend and enhance current acceleration options for their students.

Idaho’s Advanced Opportunities Initiative

In 2011, Idaho funded the first advanced opportunities program, the Mastery Advancement Program (MAP), which provided scholarships for high school students who met Idaho’s graduation requirements and graduated a full year early. In 2012, Idaho began funding the 8-in-6 Program, which funded overload courses, allowing students to complete eight years of secondary schooling in six years. Through the 8-in-6 Program, students can begin an accelerated pathway in the Grade 7, enabling them to participate in MAP by their junior year of high school. This program also allowed for participants to complete Algebra I in Grade 8, a national trend at the time, with the intent for students to continue on an advanced mathematics track through high school. Funding continued in 2013 to include the Dual Credit for Early Completers program, providing funding for dual credit courses for those students who had satisfied state graduation requirements prior to graduating and who wanted to stay in high school rather than graduating early.

The Fast Forward Program was created in 2014 to compile and fund all advanced opportunities programs for junior and seniors, under Statute 33, Chapter 46, which originally provided $200 for every junior and $400 for every senior to use toward dual credit tuition or exams (see Figure 2).

After several iterations and modifications, Statute 33-4602 was rewritten in 2016 to combine all the previously created programs into one and now allows for students, in Grades 7 through 12, who attend a public school district in Idaho to be eligible for $4,125 to be used towards defined academic advancement opportunities. Such advancement opportunities include overload courses, which are courses that are taken by a student that are in excess of a full credit bearing load at a given school district; this load includes summer courses. Another advancement opportunity defined by the statute is dual credit courses, where a student can earn course credits for both their high school and college transcripts. Dual credit courses are taught by a teacher who is qualified to teach at the post-secondary level. The final acceptable opportunity defined in the statute is examinations, specifically college-credit bearing examinations and professional certificate examinations. Eligible examinations, as defined by the statute, include the College Board's Advanced Placement (AP) exams, International Baccalaureate (IB), College-Level Examination Program (CLEP) and professional-technical examinations in fields such as health care, technology and more.


**Figure 2: Idaho Advanced Opportunities Timeline.**

Along with funding for advanced academic opportunities, the statute allows the board of each Idaho public school district to develop criteria for a student to "challenge a course" by proving that the student already meets the content knowledge in the course. If the student can prove that he/she has mastery of the content based on the criteria the school board has set forth, the statute allows for the student to be counted as completing the required coursework.

One final appropriation outlined in the statute is an advanced opportunity scholarship for any student who successfully completes Grades 1 through 12 in the Idaho public school system at a minimum of one year early. Upon completion, the student will be eligible for an advanced opportunity scholarship in the amount of thirty-five percent of the attendance funding a school district would receive if the student were to have graduated with his/her cohort. Awardees can use the scholarship to pay for tuition and fees at any Idaho public postsecondary institution.

Because each Advanced Opportunities program has its own specific parameters and eligibility requirements, it has been an administrative burden for Idaho public school counselors. So, in 2016, the Fast Forward Program streamlined all programs under one umbrella. Through revisions under House Bill 458, during the 2015 Idaho State Legislative Session, section 4602 was updated with language that provided students with a lump sum of money to be utilized towards an advanced academic opportunity pathway as determined by his/her public school district, thus minimizing the interpretation of minutiae in the prior statutes.

While the state funds the advanced opportunities coursework, and the SDE manages the funding, local public school districts are required to develop policy and procedures for the students who participate, as well as timelines and program requirements. An example six-year learning plan for a student who enters a program in Grade 7 would include two overload courses both in Grade 7 and 8 with a student's mathematics pathway organized so the student would complete Algebra I in Grade 8 with a continuation of more advanced mathematics courses with each subsequent year. In Grade 9, this same student would then take another two overload courses, thus allowing for the student to begin taking dual credit, AP or IB courses his/her Grade 10 year and on into the final two years of school where a student could graduate early or have two years of post-secondary schooling completed by the time of graduation. Students may also decide instead of a six-year plan to create an accelerated four-year plan beginning in Grade 9 (Idaho Statute 33-4600, Advanced Opportunities webpage, House Education Committee Meeting). Under the four-year plan, a participating student would most likely complete Algebra I in Grade Nine.

## Research Questions

The overall intent of the Idaho Advanced Opportunities Initiative is to increase student achievement across the state. Published data confirms that the number of students participating in Idaho's advanced opportunities programs has increased each year. The total number of participating students for the 2016-17 school year was 27,859; a 71% increase over the 2015-16 school. In addition, there was a 96.8% pass rate for dual credit courses during the 2015-16 school year (Idaho House Education Committee Meeting). However, there is little known about how Idaho's Advanced Opportunities Initiative has directly affected mathematics achievement in the state; more information is needed on enrollment demographics, pathway continuation, and completion outcomes as related to mathematics achievement. Are students completing an advanced pathway in mathematics similar to who we might expect would pursue advanced pathways regardless of incentives? Do students entering an advanced pathway in mathematics continue and complete at high rates? Are students who complete Algebra I in Grade 8 continuing on an advanced mathematics track? Answers to these questions can help get a clearer picture of the effect of Idaho's Advanced Opportunities Program on mathematics achievement.

However, because of data collection policies and laws at the state level, it is not possible to obtain precise, comprehensive data that matches advanced opportunities participation to specific students. Instead, a student achievement marker that accompanies students who most often participate in advanced opportunities was identified, and academic records were collected for each student who had this marker. That is, instead of selecting student data that indicated a student participated in one of Idaho's advanced opportunities programs, data for those students who had completed an Algebra I course or higher in Grade 8 were selected for this analysis.

To get a clearer picture of the success of district and/or school efforts towards increasing mathematics achievement in Idaho, the following research questions were answered using de-identified student and teacher data collected by the Idaho SDE:

1. For students identified as completing Algebra I or higher during Grade 8 how does their ISAT performance differ from the Grade 8 to the Grade 10 administration?

   a. How does this relate to students' gender, race, socio-economic status (SES), special education status, and English Language Learner (EL) status?
   b. How are ISAT Mathematics scores related to students' race and SES?
2. For students identified as completing Algebra I or higher during Grade 8 do they continue in an advanced mathematics pathway throughout high school?
   a. How does this differ by students' gender, race, socio-economic status (SES), special education status, and English Language Learner (EL) status?
   b. How does advanced mathematics track completion differ by race and SES?
3. For students identified as completing Algebra I or higher during Grade 8 what are the completion rates of Dual Credit and AP mathematics courses?
   a. How does this differ by students' gender, race, socio-economic status (SES), special education status, and English Language Learner (EL) status?
   b. How does AP and Dual Credit completion differ by race and low SES?

# CHAPTER TWO: LITERATURE REVIEW

In international comparisons, the average U.S. student is at a high end of proficiency in mathematics at the elementary level, slipping to middle-of-the-road proficiency levels in middle school, and then nearing the bottom of proficiency by Grade 12 (Business-Higher Education Forum, 2005). Mathematics course placement at the Grade 9 level, along with successful completion, largely determines whether or not a student has the opportunity to take advanced mathematics courses in high school (Schiller & Muller, 2003). To ensure high school graduates are prepared for post-secondary opportunities that require a high-level of mathematics proficiency, elementary and secondary schools must ensure that a student's base mathematics knowledge is met at each grade level (Business-Higher Education Forum, 2005).

## Student Achievement, Selection Bias, and Tracking

Student achievement can be traced back to Kindergarten through the use of proficiency measures, where the student achievement measure/scores of those students who typically take Algebra I as eighth graders are on average two-thirds of a standard deviation above those who do not; an indication that a student's prior proficiency measures serve as a major predictor of course placement at the middle school level. This achievement gap continues to grow as students move forward in their mathematics pathways, with those placed in Algebra I in Grade 8 being much more likely to take a course in Calculus their senior year (Domina, 2014). When determining factors that increase student achievement, it is important to consider that while the mathematics course a student is placed in at Grade 8 directly relates to a student's academic history, such as past achievement scores and grades (Rickles, 2013), it often correlates with said student's ethnicity, gender and or family background as well (Domina, 2014). According to the National Center for Education Statistics (NCES), enrollment in Algebra I at Grade 8 was more common for students of Asian descent, students from a high socio-economic status (SES), students whose mothers had attained a bachelor's degree or higher, those students who lived in a two-parent home, students attending a private school, and those who have a history of early academic achievement (Domina, 2014; Rickles, 2013; Smith, 1996; Walston, McCarroll & NCES, 2010).

Although not always recognized, there is also a positive correlation between a student's expectations of the future and his/her academic effort and ultimately success. Regardless of grade level, students who plan to complete a four-year degree have an achievement score ¼ to ½ a standard deviation higher than those who don't have the expectation (Domina, Conley & Farkas, 2009). When making policy decisions, it is important for policy makers to consider all factors.

Students who have low mathematics achievement scores on state or district proficiency measures are typically placed in remedial courses where they are given simplified instruction or moved through the content at a slower rate. Research suggests that remedial programs do not aid in bringing students up to grade level, but rather create an environment where at-risk students are at a greater disadvantage (Bloom, Ham, Melton, & O'Brien, 2001; Loveless, 2008). The act of placing students into groups based on achievement scores further divides students by other factors, such as race, ethnicity and socio-economic status. With minority students' achievement levels typically lower than their peers, students of different ethnicities and low socio-economic status (SES) are placed on such a remedial pathway. This ensures that they are not given the opportunity to work at grade-level, thus increasing the achievement gap due to the creation of an opportunity gap (Gamoran & Hannigan, 2000).

Researchers have proven through nationwide studies that the longer students are required to remain in remedial courses, the further off grade-level they become. This issue persists at the college level; in a multi-state research study of 57 community colleges, it was found that of those students who were placed on a remediation pathway, fewer than ten percent of those students go on to complete a mathematics course during their college career (Hern, 2012).

It can be argued that there is a selection bias regarding which students take advanced mathematics courses in middle school; in that, students who historically score higher on a given state or district proficiency measure will be those students who are selected to take Algebra I Grade Eight. The bias being that with only high-achieving students provided the opportunity of taking Algebra I in Grade 8, those middle-of-the-road students, who may be successful in Algebra I, are not given the opportunity to go on to advanced coursework later on in high school (Coltfelter, Ladd & Vigdore, 2012; Rickles, 2013). Other factors, such as teacher recommendations often exclude students who may benefit from an advanced pathway as well (Dougherty, Goodman, Hill, Litke & Page, 2015).

By focusing on the factors that the educational system can control, in the last couple of decades, research indicates that Algebra I is a significant prerequisite course for students to pass in order to participate in an accelerated mathematics pathway at the high school level. In this sense, Algebra I can be viewed as a gatekeeper course (Dougherty, Goodman, Hill, Litke & Page, 2015; Rickles, 2013). Early access to Algebra I, or the lack thereof, determines subsequent high school mathematics courses (Smith, 1996). Due to this, some researchers have recommended all middle school students, regardless of proficiency level, should be provided a more rigorous mathematics curriculum (Burris Heubert & Levin, 2006), resulting in the political push to grant all Grade 8 students access to Algebra I (Rickles, 2013).

## Universal Grade 8 Algebra I

The argument for universal Grade 8 Algebra I is due to two related public concerns; the first to increase the number of students ready and able to complete a four-year degree or pursue a career in fields that would increase the economic competitiveness of the United States, and the other to correct a prevalent academic inequity of only certain students having the opportunity to take Algebra I in Grade Eight (Allensworth & Nomi, 2009; Attewell & Domina, 2008; Domina, 2014; Domina, McEachin, A. Penner & E. Penner, 2015; Loveless, 2008). Such an opportunity would be most beneficial to those students who are less likely to take Algebra I in Grade 8 due to mid-level proficiency scores; those students of different ethnicities, and those coming from low SES homes (Loveless, 2008). This push to offer Algebra I coursework to all students in Grade 8 was influenced by research documenting a correlation on later success in life between those Grade 8 students provided with the opportunity to enroll in Algebra I and those who were not (Clotfelter, Ladd & Vigdor, 2012).

In 1990, a small percentage of Grade 8 students completing an Algebra I course; about one out of every six students were enrolled in such a course. Policy makers began the push to increase the number in 2000, increasing the national enrollment from 16% to 24% of all Grade 8 students. By 2007, the percentage had increased to 31% across the United States (Loveless, 2008). Research followed to determine if universal Algebra I did in fact increase the number of those students who participated in an advanced mathematics pathway in high school and later pursued a mathematics related career (Clotfelter, Ladd & Vigdor, 2012).

Proponents of universal Algebra I argue that early access ensures all students who are capable of doing the work are given the opportunity, thus allowing for students who are usually underrepresented the opportunity to get out of a remedial pathway that does not give the students the capability of ever meeting grade level content (Dougherty, Goodman, Hill, Litke & Page, 2015). Opponents of universal Algebra I argue that the course will become watered down to meet the needs of lower-achieving students, thus changing the course's predictive nature of later success (Burris, Heubert & Levin, 2004; Dougherty, Goodman, Hill, Litke & Page, 2015; Loveless, 2008). In the event that the course is not watered down, opponents believe that mandating all Grade 8 students to take a course that some are not academically prepared for is inappropriate (Domina, 2014; Dougherty, Goodman, Hill, Litke & Page, 2015), causing the student to be unsuccessful in the course without the proper supports (Dougherty, Goodman, Hill, Litke & Page, 2015) and increasing his/her mathematics learning gap (Clotfelter, Ladd & Vigdor, 2012; Domina, 2014; Loveless, 2008). Those students who are unprepared will face additional frustrations related to mathematics learning which could have the negative effect of the student dropping out of school. It would seem that with certain learning gaps prevalent with some students moving through Grades 6 and 7, a better option may be a pre-algebra course to prepare certain students for Algebra I in Grade Nine (Rickles, 2013).

While early access to Algebra I is a factor in student achievement, it is only one factor of many. There are other factors to consider such as social background, past achievement levels, instructional factors and other educational experiences. It is imperative that when determining how to increase mathematics achievement across student demographics, we look at each influence separately before we decide that early access to Algebra I is the deciding factor in mathematics achievement (Smith, 1996). Policy makers should be cautious in making large systematic changes when taking correlational research and assigning a causal relationship without considering all factors (Attewell & Domina, 2008; Clotfelter, Ladd & Vigdor, 2012). Even more so because those students who typically take Algebra I as a Grade 8 student tend to be those students who have higher scores on proficiency measures and take accelerated mathematics courses in high school; of course the data would show that early access to Algebra I is a predictor of students taking accelerated mathematics courses (Clotfelter, Ladd & Vigdor, 2012). The question is how will a student benefit by being placed in a course that they are not academically prepared for; how does equalizing the field by placing all students in an advanced course ensure that all students will leave with the same skill set and the same future educational outcomes (Attewell & Domina, 2008)?

## Current Research Findings

Looking at three research studies using longitudinal national data, most students who are assigned to advanced mathematics courses at the middle school level not only earn more mathematics credits but are also more likely to continue on an advanced mathematics pathway through high school (Burris, Heubert and Levin, 2006; Gamoran & Hannigan, 2000; Smith, 1996). The 1996 national study and a 2014 study of the Baltimore School District found that students with early access to Algebra I took one full year more of advanced mathematics courses than their peers, were more likely to take a mathematics course their senior year and had higher achievement scores on state and district proficiency measures (Durham, 2014; Smith, 1996). The 2000 national study showed that students who entered Algebra I with low-achievement scores had a lower gain than others, but still benefitted from the advanced placement (Gamoran & Hannigan, 2000). The 2006 national study focused on the results of the implementation of universal Grade 8 Algebra I and found that the percentage of minority and low SES students taking and passing advanced courses increased as well. There was no evidence to support that there was an increase in the number of students who fell behind due to misplacement. The success continued with an increase in the numbers completing college and higher earnings after college (Burris, Heubert & Levin, 2006)

However, these findings were not consistent across similar studies; a 2009 and a 2010 study on the implementation of universal Algebra I for Grade 8 students in the Chicago Public Schools found that the policy had negative effects on the mathematics achievement of their high-level students with no effect on student achievement (Nomi, 2010). However, there was a positive effect on low-level students (Allensworth & Nomi, 2009). For the Charlotte-Mecklenburg School District, universal Algebra I saw achievement scores drop and students were less likely to take additional accelerated courses through high school (Clotfelter, Ladd & Vigdor, 2012). California experienced a negative effect when universalizing Algebra I for all Grade 8 students across the state.

Overall, there was a decline in student achievement for all Grade 8 students. Being that it was a statewide implementation, the reason for an overall decrease in student achievement may have been due to some combination of curriculum, only a portion of the teachers having the content knowledge necessary to teach an advanced course, or other related factors (Domina, McEachin, A. Penner & E. Penner, 2015).

Regarding student demographics, the 2006 national study found that universal acceleration narrowed the achievement gaps related to ethnic and SES (Burris, Heubert & Levin, 2006). Two other national studies in 2003 and 2012 found that the achievement gap remained (Domina & Saldana, 2012), or “no overall differences based on race or ethnicity after controlling for prior academic performance and SES” (Schiller &Muller, 2003, p. 306). In a completely different national study in 2010, it was found that early acceleration narrowed the gender gap in students taking additional advanced courses through high school (Ma, 2010).

Overall, the most current research suggests that mandating Algebra I for all Grade 8 students is not enough to increase achievement outcomes for all students (Allensworth & Nomi, 2009; Burris, Heubert & Levin, 2004; Burris, Heubert & Levin, 2006; Domina & Saldana, 2012; Ma, 2010; Nomi, 2010; Rickles, 2013; Schiller & Muller, 2003). The move to universalize Algebra I was implemented with the intent to provide opportunities to students who were historically moved into remedial pathways with little opportunity to succeed (Loveless, 2008). However, achievement gaps persisted (Domina & Saldana, 2012). Research findings raise the question as to whether or not policy-makers can narrow the achievement gap due to so many different factors that influence student achievement (Schiller & Muller, 2003). The fact that there is a positive correlation between when a student completes Algebra I and progress through an advanced pathway does not indicate causation. Instead, studies indicate that universalizing Algebra I without a long-term, strategic plan regarding advanced pathways actually is harmful for student achievement (Clotfelter, Ladd & Vigdor, 2012). As educators, we need to focus on teaching and learning outcomes not course completion rates. We need to teach and assess pre-requisite skills and make sure to intervene early when needed to ensure overall student achievement success (Loveless, 2008).

# CHAPTER THREE: METHODOLOGY

The expressed intent of the Idaho Legislature in funding Idaho's Advanced Opportunities Initiative is to remove financial barriers in order to increase the number of students successfully completing a post-secondary program and/or moving towards a successful career. Research indicates the mathematics courses a student completes in high school directly affects their subsequent post-secondary and career pathways (Schiller & Muller, 2003), implying that the more advanced the mathematics pathway, the better prepared a student is after high school. Idaho's Advanced Opportunities Initiative directly funds programs to increase the numbers of students taking an advanced pathway, which includes mathematics. The intent of this cross-sectional statistical study is to gain insights into whether Idaho's Advanced Opportunities Program is meeting the intent behind Idaho's Advanced Opportunities Initiative in the content area of mathematics.

However, without the ability to match Idaho students to Idaho's state funded advanced opportunities programs, a mathematics achievement marker was chosen; those Grade 8 students who had completed Algebra I or higher during the first four years of advanced opportunities implementation, 2011-2014. In other words, instead of selecting student data that indicated that the student participated in one of Idaho's advanced opportunities programs, data of those students who had completed an Algebra I course or higher in Grade 8 were selected for this analysis.

To get a clearer picture of the success of district and/or school efforts towards increasing mathematics achievement in Idaho, the following research questions were answered using de-identified student and teacher data collected by the Idaho SDE:

4. For students identified as completing Algebra I or higher during Grade 8 how does their ISAT performance differ from the Grade 8 to the Grade 10 administration?
    a. How does this relate to students' gender, race, socio-economic status (SES), special education status, and English Language Learner (EL) status?
    b. How are ISAT Mathematics scores related to students' race and SES?
5. For students identified as completing Algebra I or higher during Grade 8 do they continue in an advanced mathematics pathway throughout high school?
    a. How does this differ by students' gender, race, socio-economic status (SES), special education status, and English Language Learner (EL) status?
    b. How does advanced mathematics track completion differ by race and SES?
6. For students identified as completing Algebra I or higher during Grade 8 what are the completion rates of Dual Credit and AP mathematics courses?
    a. How does this differ by students' gender, race, socio-economic status (SES), special education status, and English Language Learner (EL) status?
    b. How does AP and Dual Credit completion differ by race and low SES?

## Analysis of the Five-Year Cohorts

There were four, five-year cohorts of students included in the quantitative analysis. Each cohort begins in Grade 8 and concludes in Grade 12, and are identified by the start year of the school year in which they attended Grade 8; 2011, 2012, 2013, and 2014. For example, Grade 8 students who completed an Algebra I course or higher in the 2011-2012 school year, were included in the 2011 cohort. Complete data is not available for any of the cohorts; missing data points accompany each cohort:

- Grade 10 ISAT data is missing for the 2011 cohort
- Grade 9 ISAT data is missing for the 2012 cohort
- Grade 8 ISAT data is missing for the 2013 cohort
- The 2013 cohort includes course and pathway data up to the students' junior year, while the 2014 cohort includes course and pathway data up to the students' sophomore year

Further information on the causes for the missing data points are included in chapter 4.

## Research Strategy

The research design used cross-sectional longitudinal data provided by the Idaho State Board of Education to quantitatively analyze student achievement outcomes related to mathematics among Idaho students. The analysis used in this study is quantitative in that the relationships between and among variables of the population, related to the research questions, were analyzed through descriptive statistical summaries and cross-tabulations. The analysis will also determine, within each question, differences in outcomes by levels of demographic variables in state student databases. Tests for differences in outcomes include standard inferential methods, such as two-way analysis of variance (ANOVA) for comparisons of means across multiple groups (e.g., question 1), Chi-square tests for homogeneity and independence for comparisons of counts by categorical variables (e.g., questions 1, 2 and 3), Pearson product-moment correlation to determine statistical association between variables (e.g., question 1), and ANCOVA to determine whether means of a dependent variable are equal over the levels of an categorical independent variable, while controlling for variation of another continuous variable (e.g., question 1). The open-source statics program JASP was used to complete all statistical analyses.

## Population and Data Sets

The target population for this study was secondary mathematics students in Idaho, Grades 8 through 12, who enrolled in an Idaho public school between the years 2011 and 2017. The group for which comparative analyses were conducted is those students who completed Algebra I or higher in their Grade 8 school year.

There were four, five-year cohorts of students included in the quantitative analysis. Each cohort begins in Grade 8 and concludes in the Grade 12, and were identified by the start year of the school year in which they attended Grade 8; 2011, 2012, 2013, and 2014. For example, a Grade 8 student who completed an Algebra I course or higher in the 2011-12 school year was included in the 2011 cohort.

The transcript and proficiency data were obtained through the Idaho Board of Education’s Data Management Council after signing a memorandum of understanding (MOU). The data were collected from Idaho’s longitudinal data system, which collects school transcript and academic achievement records as required by federal and state data collection guidelines.

The data set collected included every Idaho secondary student who completed Algebra I or higher during Grade 8, for the cohorts described above, enrolled in an Idaho public school with all student demographics, Idaho Standards Achievement Test (ISAT) scores from 2012 through 2017, as well as mathematics course pathways. Cross tabulations and summaries were used to describe the data collected.

## Analysis Description

First, Chi-square tests were ran to test for the independence of ISAT performance levels from Grade 8 to Grade 10 (see Table 1 for statistical hypothesis). This was done across cohorts, for each cohort separately, and across student demographics.

**Table 1: Comparison of Mathematics Course Tracks**

| | **Statistical Hypothesis** |
|---|---|
| **$H_0$** | Students' Grade 10 ISAT mathematics performance levels are independent of their Grade 8 ISAT mathematics performance levels |
| **$H_1$** | Students' Grade 10 ISAT mathematics performance levels are statistically associated with their Grade 8 ISAT mathematics performance levels |

A Pearson's product-moment correlation test, *r*, was used to determine whether ISAT z-scores at Grade 8 and Grade 10 levels were statistically associated (see statistical hypothesis in Table 2 for statistical hypothesis).

**Table 2: ISAT Mean Statistical Hypothesis**

| | **Statistical Hypothesis** |
|---|---|
| **$H_0$** | Students' Grade 8 ISAT scores are independent of their Grade 10 ISAT scores |

| | |
|---|---|
| **$H_1$** | Students' Grade 8 ISAT scores are statistically associated with their Grade 10 ISAT scores |

ANOVA procedures were used to determine whether one or more student demographics of those students in Grade 8, on an advanced mathematics path, is/are predictive of students' Grade 10 ISAT scores (see Table 3 for statistical hypothesis).

**Table 3: Statistical Hypothesis of Student Demographic Predictive of Tenth Grade ISAT**

| | **Statistical Hypothesis** |
|---|---|
| **$H_0$** | Student demographic variables are not associated with their Grade 10 ISAT Mathematics scores |
| **$H_1$** | Student demographic variables are statistically associated with their Grade 10 ISAT Mathematics scores |

Finally, in looking at ISAT scores, ANCOVA was utilized to control for the Grade 8 ISAT scores of those Grade 8 students on an advanced mathematics pathway, providing a clearing picture of race and FRL status interaction on predicting Grade 10 ISAT scores (see Table 4 for the statistical hypothesis).

**Table 4: Statistical Hypothesis of Interaction of Student Demographics Predictive of Tenth Grade ISAT**

| | **Statistical Hypothesis** |
|---|---|
| **$H_0$** | After adjusting for Grade 8 ISAT Mathematics performance, combinations of student demographic variables are not associated with Grade 10 ISAT Mathematics performance. |
| **$H_1$** | After adjusting for Grade 8 ISAT Mathematics performance, combinations of student demographic variables are statistically associated with Grade 10 ISAT Mathematics performance. |

To determine whether students who were identified as starting an advanced mathematics track in Grade 8 continue in an advanced mathematics pathway through their high school career, cross tabulation tables were utilized. The tables provide information on movement across the four cohorts, to include student demographics, as well as movement within cohorts.

Extending an existing classification system for secondary mathematics course pathways in Idaho (Champion & Carney, 2017), students were placed in categories that define where students are within their mathematics path at each grade level of their secondary schooling. These categories included Low, On-track, and Advanced pathways, and indicate whether a student, at each grade level, was below, at, or above grade level, respectively, in Idaho's existing high school courses (see Table 5).

For instance, if students were enrolled in Algebra II in Grade 9, they would be considered above grade level within their mathematics pathway, while students enrolled in Algebra I in Grade 10 would be considered below grade level. The extension of this system was independently validated by Idaho public school educators, principals and other district leaders as part of the research effort.

**Table 5: Mathematics Pathway Categorization of Idaho Mathematics Courses by Grade**

| Course Code | Course Name | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|
| 2046 | Mathematics – Special Education (Gr. 9-12) | Low | Low | Low | Low | Low |
| 2151 | General Applied Mathematics (Gr. 9-12) | Low | Low | Low | Low | Low |
| 2002 | General Mathematics (Gr. 9-12) | Low | Low | Low | Low | Low |
| 2074 | Principles of Algebra & Geometry (Gr. 9-12) | Low | Low | Low | Low | Low |
| 2153 | Technical Math | Low | Low | Low | Low | Low |
| 2154 | Business Math | Low | Low | Low | Low | Low |
| 2157 | Consumer Math/Personal Finance | Low | Low | Low | Low | Low |
| 52046 | Mathematics – Special Education (Gr. 6-8) | Low | | | | |
| 52151 | General Applied Mathematics (Gr. 6-8) | Low | | | | |
| 52002 | General Mathematics (Gr. 6-8) | On-Track | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 52051 | Pre-Algebra (Gr. 6-8) | On-Track | | | | |
| 52074 | Principles of Algebra & Geometry (Gr. 6-8) | On-Track | | | | |
| 2052 | Algebra I (Grades 9-12) | Adv. | On-Track | Low | Low | Low |
| 2060 | Integrated Math - Year One (Grades 9-12) | Adv. | On-Track | Low | Low | Low |
| 2061 | Integrated Math Multi-year | Adv. | On-Track (Yr. 1) | On-Track (Yr. 2) | On-Track (Yr. 3) | On-Track (Yr. 4) |
| 2072 | Geometry (Grades 9-12) | Adv. | Adv. | On-Track | Low | Low |
| 2056 | Algebra II (Grades 9-12) | Adv. | Adv. | Adv. | On-Track | Low |
| 2106 | Algebra/Trigonometry | Adv. | Adv. | Adv. | On-Track | Low |
| 2103 | Trigonometry | Adv. | Adv. | Adv. | On-Track | Low |
| 2104 | Math Analysis | Adv. | Adv. | Adv. | Adv. | On-Track |
| 2201 | Probability and Statistics | Adv. | Adv. | Adv. | Adv. | On-Track |
| 2110 | Pre-Calculus | Adv. | Adv. | Adv. | Adv. | On-Track |
| 2121 | Calculus | Adv. | Adv. | Adv. | Adv. | Adv. |
| 2124 | AP Calculus AB | Adv. | Adv. | Adv. | Adv. | Adv. |
| 2125 | AP Calculus BC | Adv. | Adv. | Adv. | Adv. | Adv. |
| 2203 | AP Statistics | Adv. | Adv. | Adv. | Adv. | Adv. |
| 2131 | IB Mathematical Studies | Adv. | Adv. | Adv. | Adv. | Adv. |
| 2132 | IB Mathematics | Adv. | Adv. | Adv. | Adv. | Adv. |
| 52052 | Algebra I (Grades 6-8) | Adv. | | | | |
| 52072 | Geometry (Grades 6-8) | Adv. | | | | |
| 52056 | Algebra II (Grades 6-8) | Adv. | | | | |
| 52060 | Integrated Math - Year One (Grades 6-8) | Adv. | | | | |

Since all students in the sample completed Algebra I or higher in Grade 8, the entire population were on the advanced mathematics path in Grade 8. Cross tabulation tables provided a view of whether or not students stayed on an advanced mathematics path year-after-year. Chi-square tests were ran to determine whether the students continued on an advanced mathematics pathway through their high school career (see Table 6 for statistical hypotheses).

**Table 6: Comparison of Mathematics Course Tracks**

| | Statistical Hypothesis |
|---|---|
| $H_0$ | Students in advanced coursework in Grade 8 remained in advanced courses in subsequent grades. |
| $H_1$ | Statistically significant percentages of students in advanced coursework in Grade 8 moved to lower course pathways in subsequent grades. |

The purpose of Idaho's Advanced Opportunities Initiative is to remove financial barriers from students, thus allowing more students to take an advanced academic path. This would allow for an increased number of students completing coursework well above grade level, so they are able to graduate prepared for career or entrance into credit-bearing coursework in college; meaning that students on an advanced pathway should be taking mathematics courses above grade level. Utilization of the Chi-square test determines how likely it is that the observed distribution in the cross tabulation is due to chance or if, in fact, students who complete Algebra I or higher during their Grade 8 year are continuing and completing advanced mathematics courses.

To determine if there was an association between student demographic variables and the completion of Dual Credit and AP mathematics courses, the Chi-square independence test was used (see Table 7 for statistical hypothesis).

**Table 7: Differences in AP Courses**

| | Statistical Hypothesis |
|---|---|
| $H_0$ | Students' completion of Dual Credit and AP mathematics courses is independent of student demographic variables |
| $H_1$ | Students' completion of Dual Credit and AP mathematics courses is statistically associated with student demographic variables |

## Research Limitations

There are three main limitations to consider when interpreting this study. First, as an observational study, the research does not include prospective evaluation of an intervention, so cannot allow for causal claims on the effect of offering advanced pathways to students. The participants were not, for example, randomly assigned to one of the four comparison groups, so that all findings are subject to self-selection bias.

Second, data quality (especially in advanced program enrollment and course transcript records) is subject to potential errors and omissions. The data is uploaded by district personnel and not independently verified (in most cases), and the information is likely to be not comprehensive. This becomes apparent, for example, when trying to match multiple ISAT scores to one student, or when considering inconsistencies in reported dual credit courses.

Data quality was also apparent when looking at the socio-economic (SES) student demographic. As in every state in the United States, students in Idaho qualify to participate in federal Child Nutrition Programs (CNPs). Students qualify through a federal regulation based on family size and income. CNPs provide funding at the state level to be distributed to public school districts, in order to provide milk, breakfast and/or lunch to students, who qualify, at a reduced cost or no cost at all; this qualification is termed free or reduced lunch (FRL) status. Rather than collect individual applications from students to determine eligibility for FRL status, public school districts can choose to adopt Community Eligibility Provision (CEP). CEP inclusion is based on the percentage of students who normally qualify for FRL status, such as students who participate in the Supplemental Nutrition Assistance Program and homeless students (USDA). If a school or district has CEP status, then every student at the school is considered CEP; at this time, for CEP schools, there is no way to differentiate between students who actually qualify for FRL status and those who do not.

Finally, much of the variation in student outcomes may be attributable to potential differences in the academic programs themselves. State policies leave creation of mathematics advanced pathways primarily to local educators under district control, which may directly relate to the successfulness of one program over another. It may be that one district’s program has greater capacity for offering quantity and quality opportunities (subject to funding, experience of educators, etc.). Likewise, another program may be more inclusive in offering programs to students from varying demographic backgrounds.

# CHAPTER FOUR: RESULTS

The sample included academic records for 37,207 students across the four, five-year cohorts.

## Data Description

At the state level, the total number of Idaho students on an advanced mathematics path in Grade 8, as identified by their completion of Algebra I or higher, across the four, five-year cohorts was similar year-over-year. On average, across the school years from 2011-12 to 2014-2015, approximately 41% of Idaho Grade 8 students were on an advanced mathematics path. A total of 7,905 students were on an advanced path beginning in the 2011 cohort. The 2012 cohort saw a small increase with 10,513 students on an advanced path. The following two years dropped the count to 9,621 and 9,167, respectively.

### Gender

When looking at gender only, there were no substantial differences between the percentages of males to that of females, averaging a 50% split across the four cohorts, with males typically over the 50% mark and females falling just under. This percentage split is typical of the overall state percentage of enrolled Grade 8 male and females for each cohort.

Separating gender distributions by students' identified race, the percentages were typical to that of overall state enrollment rates for Grade 8 by cohort.

### Race

White/Caucasian students represented a greater percentage over all four cohorts, with the percentage staying between 82.8 and 84.2% over the four years. This percentage is greater than the state percentage of White/Caucasian Grade 8 students enrolled in a public school district for each cohort, which averaged at 77% over the four cohorts. Hispanic/Latino students comprised between 10.7 and 11.1% of the sample over the four years. This percentage is lower than the enrollment rate of Hispanic/Latino Grade 8 students for each cohort analyzed, which was 16.8%. All other races identified, American Indian/Alaskan Native, Asian, Black/African American, Hawaiian/Other Pacific Islander, or multiple races, completed an Algebra I course or higher in Grade 8 at a percentage of approximately 2% or lower. These percentages were typical of the overall Grade 8 enrollment rates, by race, for each cohort.

<u>Socio-Economic Status (SES)</u>

FRL status data excludes those students who are enrolled in a CEP provisioned school (see research limitations in chapter 3); thus reducing the total number of students within this subset to be lower than the total sample by 425 students

The subset of students who came from a family with low SES means (as identified by those who qualified for FRL status), within the set of students who completed Algebra I or higher in Grade 8, was at 38.6% for the 11-12 cohort. There was a decrease to 33.3% during the 12-13 school year, a slight increase to 34% during the 13-14 school year, with the 14-15 cohort ending at 33.5%; an overall decrease of 5.1% from the beginning cohort to the 14-15 cohort. These annual percentages are below the state enrollment average of students who qualified for FRL status, over the fours cohorts, at 45.3%

Separating FRL status by race, across the four cohorts, of those students with low SES, 72.6% were identified as White/Caucasian, while approximately 21.5% were identified as Hispanic/Latino. The remaining 5.9% was distributed between American Indian/Alaskan Native, Asian, Black/African America, Hawaiian or Other Pacific Islander, or multiple races (see Table 8). These percentages differed from the overall state percentages of FRL status by race across the cohorts, in which low SES White/Caucasian students comprise 66.8% of the population, while their Hispanic/Latino counterparts average 26.6% of the population.

**Table 8: Advanced Track 8th Grade Cohorts by Race and FRL Status**

| | | | | Race | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **F RL.SES** | **artYear** | **St** | | **M** | **S** | **L** | | **I O** | | **H** | **otal** |
| H igh SES | 011 | 2 | ount | 6 | 2 | 8 | 15 | 4 | 8 | 402 | 855 |
| | | | within row | .3 % | .9 % | .4 % | .4 % | .3 % | % | 0.7 % | 00 % |
| | 012 | 2 | ount | 5 | 42 | 7 | 42 | 3 | 63 | 178 | 010 |
| | | | within row | .5 % | % | .4 % | .3 % | .3 % | .3 % | 8.1 % | 00 % |
| | 013 | 2 | ount | 4 | 27 | 3 | 25 | 6 | 61 | 573 | 259 |
| | | | within row | .4 % | % | .5 % | .2 % | .3 % | .6 % | 9 % | 00 % |
| | 014 | 2 | ount | 7 | 19 | 6 | 92 | 6 | 43 | 245 | 898 |
| | | | within row | .5 % | % | .8 % | % | .4 % | .4 % | 8.9 % | 00 % |
| | otal | T | ount | 02 | 80 | 24 | 274 | 9 | 65 | 1398 | 4022 |
| | | | within row | .4 % | % | .5 % | .3 % | .3 % | .4 % | 9.1 % | 00 % |
| L ow SES | 011 | 2 | ount | 5 | 4 | 3 | 34 | 4 | 4 | 257 | 051 |
| | | | within row | .8 % | .8 % | .1 % | 0.8 % | .5 % | .1 % | 4 % | 00 % |

| F<br>RL.SES | artYear | St | | Race<br>M | S | L | | I<br>O | | H | otal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 012 | 2 | ount | 9 | 3 | 6 | 07 | 1 | 6 | 571 | 503 |
| | | | within row | .1 % | .8 % | % | 0.2 % | .3 % | .2 % | 3.4 % | 00 % |
| | 013 | 2 | ount | 7 | 7 | 9 | 37 | 3 | 6 | 302 | 231 |
| | | | within row | .8 % | .5 % | .2 % | 2.8 % | .4 % | % | 1.2 % | 00 % |
| | 014 | 2 | ount | 0 | 0 | 6 | 62 | | 6 | 132 | 975 |
| | | | within row | .7 % | .3 % | .5 % | 2.3 % | .3 % | .2 % | 1.7 % | 00 % |
| | otal | T | ount | 11 | 74 | 54 | 740 | 7 | 72 | 262 | 2760 |
| | | | within row | .9 % | .4 % | .2 % | 1.5 % | .4 % | .1 % | 2.6 % | 00 % |
| T<br>otal | 011 | 2 | ount | 1 | 16 | 1 | 49 | 8 | 62 | 659 | 906 |
| | | | within row | .5 % | .5 % | .6 % | 0.7 % | .4 % | % | 4.2 % | 00 % |
| | 012 | 2 | ount | 4 | 05 | 3 | 149 | 4 | 39 | 749 | 0513 |
| | | | within row | .7 % | .9 % | .6 % | 0.9 % | .3 % | .3 % | 3.2 % | 00 % |
| | 013 | 2 | ount | 2 | 76 | 5 | 072 | 9 | 31 | 976 | 621 |
| | | | within row | .6 % | .8 % | .8 % | 1.1 % | .3 % | .4 % | 2.9 % | 00 % |
| | 014 | 2 | ount | 0 | 66 | 4 | 003 | 5 | 20 | 589 | 167 |
| | | | within row | .7 % | .8 % | % | 0.9 % | .4 % | .4 % | 2.8 % | 00 % |
| | otal | T | ount | 37 | 63 | 83 | 073 | 26 | 52 | 0973 | 7207 |
| | | | within row | .6 % | .8 % | .8 % | 0.9 % | .3 % | .3 % | 3.2 % | 00 % |

Special Education Status

Of those students completing an Algebra I course or higher in Grade 8, 1.8% within the 11-12 cohort were receiving special education services. This percentage almost doubled to 3.1% during the 12-13 school year and continued to increase to 3.4 and then 4.1% during the 13-15 and 14-15 school years, respectfully. These percentages are substantially lower than the percentage of Grade 8 students receiving special education services enrolled in an Idaho public school district, for each cohort, which averaged at 9%.

Separating students receiving special education services by race, the greatest percent of students on an advanced mathematics track who received special education services were White/Caucasian, with an average of 79.8% across the cohorts. Those students who identified as Hispanic/Latino were next at 12.6%. The percentages of White/Caucasians were similar to overall state enrollment rates, while the Hispanic/Latino percentage was lower than the statewide enrollment rate (18.6%) in special education services.

In isolating the subset of students receiving special education services by race, within those students who were identified by an Idaho public school district as qualifying for FRL status, the greatest percentage of students identified as White/Caucasian across all four cohorts, averaging at 74.2%, followed by those identifying as Hispanic/Latino at a much lower rate averaging at 18.7%.

English Language Learners (ELs)

Of those students who were on an advanced mathematics track as Grade 8 students across the four cohorts, an average of 1.2% were identified as English language learners (ELs) by their Idaho public school district, which was below the state enrollment average of 3.29%. Separating ELs by race, the greatest percentage of EL students identified as Hispanic; averaging 67.4% across the cohorts. ELs identifying as a White/Caucasian race, have the next greatest percentage; however, the percentage averages at a much lower rate of 13.7% over the four cohorts. Students identifying as Asian ELs was at 10.7%, Black/African American at 7.5%, and 0.7% identify as American Indian/Alaskan Native. This is not typical of the state enrollment rates of EL students by race; Hispanics/Latino at 15.1%, White/Caucasian at 0.32%, Asian at 37.5%, Black/African American at 17.54%, American Indian/Alaskan Native at 7.1%. In isolating the subset of ELs by race within those students who were identified by an Idaho public school district as qualifying for FRL status, 71.4% identified as Hispanic/Latino, 12.8% as White/Caucasian, 9.2% as Black/African American and 6.5% as Asian.

## Inferential Analysis

To learn about the effectiveness of the Idaho Advanced Opportunities Initiative, the study sought to answer three questions, each of which addresses differences across demographic variables:

1. For students identified as completing Algebra I or higher during Grade 8 how does their ISAT performance differ from the Grade 8 to the Grade 10 administration?
2. For students identified as completing Algebra I or higher during Grade 8 do they continue in an advanced mathematics pathway throughout high school?
3. For students identified as completing Algebra I or higher during Grade 8 what are the completion rates of Dual Credit and AP mathematics courses?

Idaho Standards Achievement Test (ISAT)

Occurring simultaneously with the implementation of the Advanced Opportunities Initiative, was the piloting and implementing of a new state accountability assessment that aligned to the new mathematics content standards adopted by the state in 2010. This new Idaho State Achievement Test (ISAT) was developed out of the Smarter Balanced Assessment Consortium, of which Idaho is a member state.

While the adoption of the standards occurred in 2010, Idaho public school districts were not required to implement the standards until the 2011-2012 school year. This meant that students were assessed on the old standards during the 2011, 2012 and 2013 administrations, and a pilot test for the new assessment occurred during the 2014 administration, leaving Idaho without ISAT scores for the year except for those districts who utilized the old ISAT for local purposes. The new assessment was fully implemented beginning with the 2015 administration (see Table 9). Idaho does not have data for the 2011 ISAT administration within the state's longitudinal data system, because the state did not begin collecting longitudinal data until the 2011-2012 school year.

**Table 9: Idaho Eighth Grade Cohorts and Respective ISAT Administrations**

| **Grade 8 Cohorts** | **Grade 8 ISAT** | **Grade 10 ISAT** |
|---|---|---|
| **2011-2012 Cohort** | 2012: Old | 2014: Field Test |
| **2012-2013 Cohort** | 2013: Old<br>Pilot – New | 2015: New |
| **2013-2014 Cohort** | 2014: Field Test<br>No ISAT Data | 2016: New |
| **2014-2015 Cohort** | 2015: New | 2017: New |

First, students' Grade 10 ISAT performance levels were statistically associated with their Grade 8 ISAT performance levels ($\chi^2 = 7433.4$, $p < .001$). This was not only true across all four cohorts, but for each cohort that had a Grade 8 and Grade 10 ISAT administration to compare; 2011 ($\chi^2 = 159.5$, $p < .001$), 2012 ($\chi^2 = 3761.7$, $p < .001$), and 2014 ($\chi^2 = 5599.7$, $p < .001$). Comparisons for the 2013 cohort could not be made due to the pilot year for the new ISAT, making it so there were no Grade 8 scores to collect. This was true for all student demographic variables, as well as for all state locales.

Scale scores from state accountability tests can be informative in regards to students' current achievement levels and for determining growth in achievement over time, as well as gaps in learning. However, with the administration of two different ISATs, aligned to two different sets of standards, with two very different scale scores, shortly after implementation of the Advanced Opportunities Initiative, a direct comparison of ISAT scale scores during this time period could not occur. In order to analyze the relationship between ISAT scores, over time, of those students on an advanced track, the ISAT scores were converted to z-scores.

Students' Grade 8 ISAT Mathematics z-scores were highly correlated with their Grade 10 ISAT Mathematics z-scores ($r = 0.689$, $p < .001$). Difference in means by gender for the Grade 10 ISAT were not statistically significant ($F = 3.562$, $p = 0.059$. Difference in means of race and the Grade 10 ISAT were significantly significant ($F=152.8$, $p < .001$). This held true for differences of means between FRL status ($F=1150$, $p < .001$), receiving special education services ($F=760.2$, $p < .001$), EL status ($F=315.8$, $p < .001$) and Grade 10 ISAT scores. These results indicate that gender was not associated with how well Grade 8 students on an advanced mathematics path scored on their Grade 10 ISAT, while race, FRL status, special education status and EL status were associated with Grade 10 ISAT performance.

This pattern held true for each cohort, except for the 2011 cohort, where differences in means for gender, race, FRL status, special education status, and EL status, with the Grade 10 ISAT scores, were not statistically significant (see Table 10). This means that for 2011 none of the student demographics were predictive of students' Grade 10 ISAT score. This may have been due to the only Grade 10 data available for the 2011 cohort being that of a minimal number of districts who continue to give the old ISAT, for various local reasons, during the field test year for the new assessment.

With the mean scores for the Grade 8 ISAT results, as well as race and FRL status, all associated with Grade 10 ISAT results, it was useful to determine whether

**Table 10: Effect on Grade 10 ISAT by Cohort**

| | **Effect (F-values) on Grade 10 ISAT by Cohort** | | | |
|---|---|---|---|---|
| | **2011** | **2012** | **2013** | **2014** |
| **Gender** | 1.13 | 2.47 | 0.26 | 3.36 |
| **Race** | 2.42* | 42.00*** | 62.33*** | 92.40*** |
| **FRL Status** | 7.24** | 290.40*** | 437.10*** | 719.40*** |
| **Sp. Ed. Status** | 948.00** | 206.60*** | 200.60*** | 556.10*** |
| **EL Status** | 6.10* | 82.70*** | 143.20*** | 172.20*** |

*Note*: * = p < .05, ** = p < .01, *** = p < .001

these three variables interacted. Figure 3 and Table 11 summarizes the differences in Grade 10 ISAT mathematics results by race and FRL status. The figure suggests that, overall, students who come from a family that does not qualify for FRL status do better on the Grade 10 ISAT regardless of race. The lines off of each of the dots in the figure indicate 95% confidence intervals around each sub-population estimate, meaning that the Grade 10 z-score for that sub-population is likely to lie within the band margin around the point estimate. This is especially pronounced for those sub-populations/races which have a small population size in comparison to the overall group size. For instance, American Indian/Alaskan Native, low and high SES, have confidence intervals that nearly touch (low end of high SES; high end of low SES), which could see the Grade 10 ISAT mean values sitting right next to each other. For instance Hawaiian/Other Pacific Islander students have standard errors that overlap, meaning that high SES, Grade 10 z-scores could fall below that of the low SES, Grade 10 z-scores, and White/Caucasian students have small confidence intervals due to their large population size. Looking further, Asians score higher on the ISAT, while those students identified as Black/African American have some of the lowest scores.

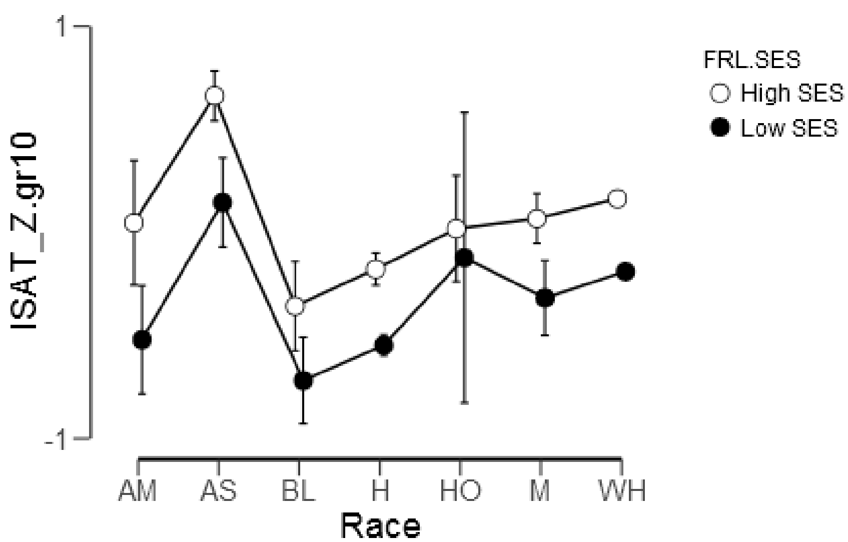


**Figure 3: Difference in Grade 10 ISAT Mathematics Results by Race and FRL status.**

**Table 11: Grade 10 ISAT Mathematics Results by Race and FRL Status**

**Descriptives - ISAT_Z.gr10**

| Race | FRL.SES | Mean | SD | N |
|---|---|---|---|---|
| AM | High SES | 0.046 | 1.076 | 51 |
| | Low SES | -0.521 | 0.902 | 48 |

**Descriptives - ISAT_Z.gr10**

| Race | FRL.SES | Mean | SD | N |
|---|---|---|---|---|
| AS | High SES | 0.663 | 0.896 | 214 |
| | Low SES | 0.145 | 1.033 | 90 |
| BL | High SES | -0.358 | 0.824 | 58 |
| | Low SES | -0.719 | 0.847 | 65 |
| H | High SES | -0.179 | 1.008 | 636 |
| | Low SES | -0.548 | 0.896 | 1208 |
| HO | High SES | 0.017 | 0.837 | 43 |
| | Low SES | -0.123 | 1.273 | 15 |
| M | High SES | 0.067 | 1.002 | 266 |
| | Low SES | -0.319 | 1.009 | 121 |
| WH | High SES | 0.164 | 0.970 | 10094 |
| | Low SES | -0.190 | 0.982 | 3926 |

ANCOVA was utilized to control for the Grade 8 ISAT scores of those students on an advanced mathematics pathway, providing a clearer picture of race and FRL status interaction on predicting Grade 10 ISAT scores. While separately, race ($F = 7.426$, $p < .001$) and FRL status ($F = 16.713$, $p < .001$) were statistically significant, together, the interaction was not statistically significant ($F = 1.829$, $p = .089$). Table 12 suggests students' Grade 8 ISAT scores had the greatest association with their Grade 10 ISAT scores. FRL status was the next most significant variable, then race, and finally the interaction between race and FRL status. This is important because, for instance, race wouldn't have been significant in the ANCOVA analysis unless the relative position of means across race subgroups changed between Grade 8 and Grade 10, so that the gaps between racial groups increased.

**Table 12: Grade 10 ISAT Mathematics Results by Race and FRL Status While Controlling Grade 8 ISAT Mathematics Results**

**ANCOVA - ISAT_Z.gr10**

| Cases | Sum of Squares | df | Mean Square | F | p |
|---|---|---|---|---|---|
| Race | 2385 | 6 | 3.847 | 7.426 | < .001 |
| FRL.SES | 8.659 | 1 | 8.659 | 16.713 | < .001 |
| Race ∗ FRL.SES | 5.685 | 6 | 0.948 | 1.829 | .089 |
| ISAT_Z gr8 | 7072.527 | 1 | 7072.527 | 13650.219 | < .001 |
| Residual | 8714.871 | 16820 | 0.518 | | |

*Note.* Type III Sum of Squares

Advanced Mathematics Pathway

Since all students in the sample were enrolled in advanced mathematics courses in Grade 8, cross-tabulations provided a tool for assessing changes in students' course pathways in Grades 9 to 12.

From Grade 8 to Grade 9, there was a statistical decrease in students' mathematics path ($\chi^2 = 15302$, $p < .001$), with 53.5% of students remaining on an advanced mathematics path across the cohorts and 43.6% moving to an on-track path (see Figure 4).

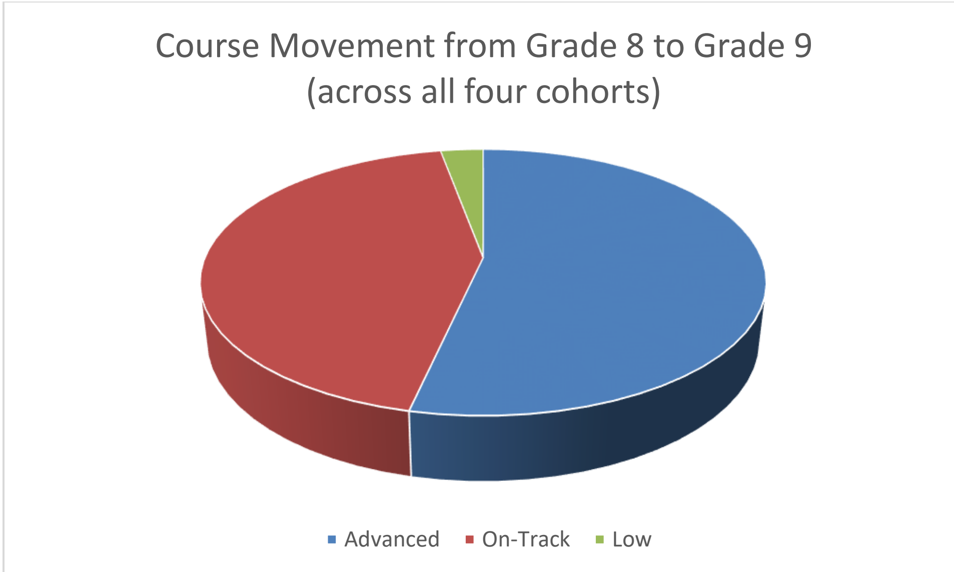


**Figure 4: Course Movement from Grade 8 to Grade 9 of Idaho's Grade 8 Students on an Advanced Mathematics Path.**

In looking at each cohort individually, each subsequent cohort dropped in the percentage of students remaining on an advanced mathematics path; 2011 (75.1%), 2012 (50.2%), 2013 (48.4%), and 2014 (43.8%).

From Grade 8 to 10, there was a statistical difference in the population's mathematics path over time ($\chi^2 = 10902$, $p < .001$), with 52.4% of students remaining on an advanced mathematics path across the cohorts. The average percentage of students, overall, on the on-track path dropped from 43.6 % to 39.9%, shifting to the number of students to the low path, now averaging 7.7% of the students who started on an advanced mathematics path in the Grade 8 across the four cohorts (see Figure 5).

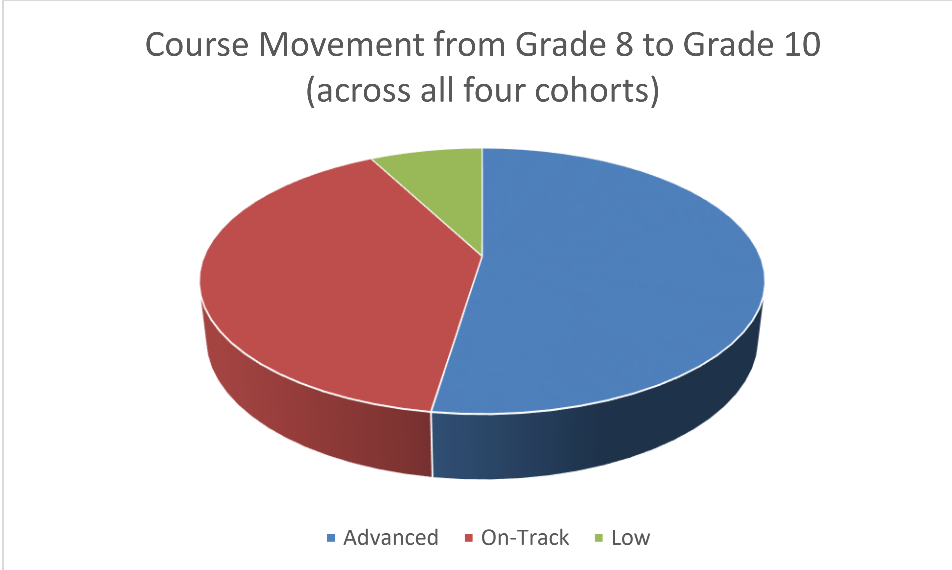


**Figure 5: Course Movement from Grade 8 to Grade 10 of Idaho's Grade 8 Students on an Advanced Mathematics Path.**

In looking at each cohort individually, each subsequent cohort continues to drop in the percentage of students remaining on an advanced mathematics path; 2011 (72%), 2012 (48.2%), 2013 (47.5%), and 2014 (45.1%).

From Grade 8 to 11, there was a statistical difference in the population's mathematics path over time ($\chi^2 = 5762$, $p < .001$), with 43.7% of students remaining on an advanced mathematics path across the cohorts. In looking at each cohort individually, each subsequent cohort continues to drop in the percentage of students remaining on an advanced mathematics path; 2011 (52.9%), 2012 (36.6%), and 2013 (43.6%). Mathematics paths, for the 2014 cohort, from Grade 8 to 11 cannot be analyzed; the student population is currently in Grade Ten. The average percentage of students, for the first three cohorts, on the on-track path had an increase from 39.9% to 46.2%; the percentage of students shifting to the low track increased from 7.7% to 10.1% of the students who were on an advanced mathematics path in Grade 8 across the four cohorts (see Figure 6).

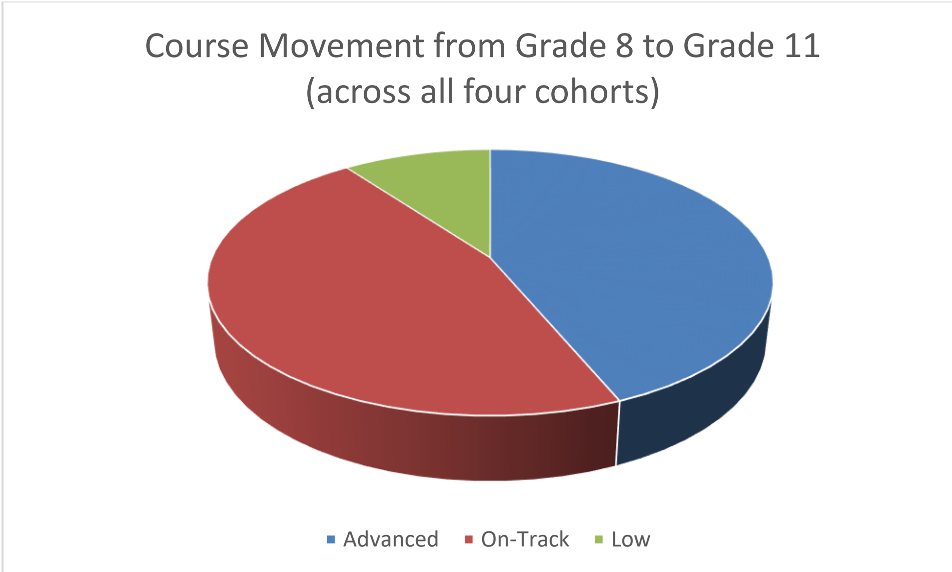


**Figure 6: Course Movement from Grade 8 to Grade 11 of Idaho's Grade 8 Students on an Advanced Mathematics Path.**

From Grade 8 to 12, there was a statistical difference in the population's mathematics path over time ($\chi^2 = 212.3$, $p < .001$), with 38.4% of students who were once an advanced mathematics path in the Grade 8 remaining. There was a drop in the percentage of students remaining on an advanced mathematics path across the 2011 (42%) and 2012 (35.6%) cohorts. (Mathematics paths for the 2013 and 2014 cohorts cannot be analyzed; the student populations are currently in Grade 11 and 10, respectively.) The average percentage of students, for the first two cohorts, on the on-track path decreased to 28.6%, with those on a low track in their last year of high school averaging at 33% of the student population (see Figure 7).

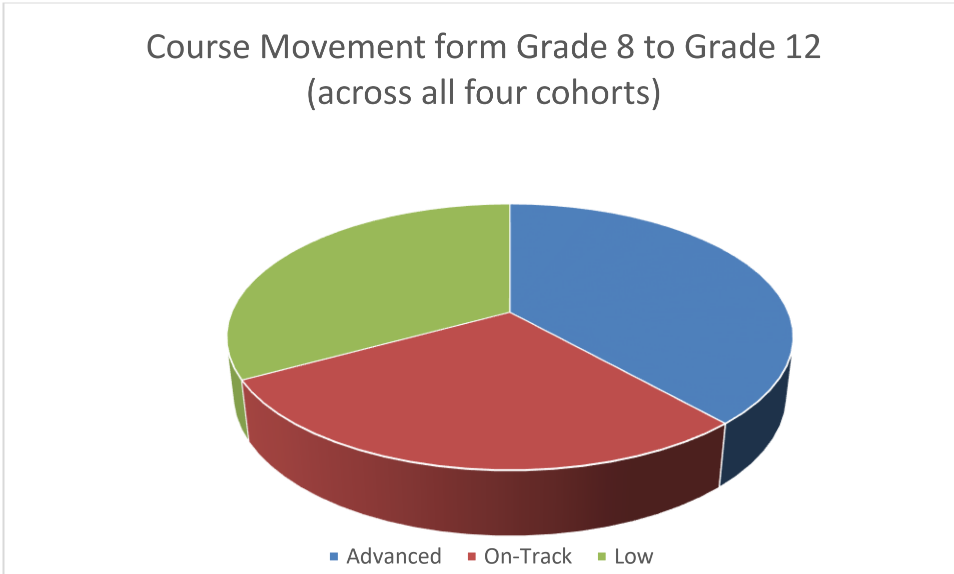


**Figure 7: Course Movement from Grade 8 to Grade 12 of Idaho's Grade 8 Students on an Advanced Mathematics Path.**

Cross tabulations summarized differences in the overall student population across the four cohorts. In regards to gender, the percentage of males and females who remained on an advanced mathematics path year-over-year stayed within 3% of each other, with only a 0.2% difference in Grade Twelve. From Grade 8 to 12, 38.5% of females and 38.3% of males remained on an advanced mathematics path.

In regards to race, overall, all races had a steady decrease in the percentages of students remaining on an advanced mathematics path. Those students identifying as Asian had the greatest percentage of students remaining on the advanced mathematics path over time, with 66.2% of the population remaining on the advanced path by the end of their Grade 12 year. Of those students identifying as Hawaiian/Other Pacific Islander, 42.6% remained in the advanced mathematics path their Grade 12 year, while students identifying as White/Caucasian and Multiple races, averaged at 39.4% and 38.1%, respectively. Of those students identifying as Black/African American, Hispanic/Latino, and American Indian/Alaskan Native, 28.2%, 27.9% and 23.1% remained on an advanced mathematics path their Grade 12 year.

For those students who qualified for FRL status, only 30% remained on an advanced mathematics path through high school; this is 8.4% lower than the overall student population identified. For Grades 9, 10 and 11, the percentage of those shifting to the on-track path stayed between 40.3% and 48%; however, during the population's Grade 12 year, there was a significant shift, with 43.2% moving to the low path and 26.8% being on-track. This differed from the student population that did not qualify for FRL status, with 27.8% shifting to the low track; a 15.4% difference.

For those Grade 8 students on an advanced mathematics path who qualified for special education services, only 13.9% remained on an advanced path the subsequent year in Grade Nine. This percentage remained consistent year-over-year, with a slight increase in the Grade 11 with 21.7% on an advanced path. The percentage of the student population primarily shifted to an on-track status, 72.1% during Grade 9, 49.6% during the Grade 10, and 45% during Grade Eleven. During Grade 12, this student population saw the most dramatic shift to the low track; 53.5% of the original population shifted from an advanced path to a low path.

Only 15.1% of those Grade 8 students who identified as EL remained on an advanced mathematics path during Grade 12. During the student population's Grade 9 year, 73.3% of the students shifted to being on-track, while 11.2% shifted to the low track. The shift to the low track was greater during Grade 10, with 30.6% of the students moving to the low path and 54.1% on-track. This trend continued in the population's

Grade 11 and 12 years, with 47.9% on-track and 33.9% on a low path; 35.0% on-track and 49.7% on a low path, respectively.

Advanced Placement (AP) Course Completion

While Idaho has provided funding, through the Advanced Opportunities Initiative, for students to take dual credit courses, as well as AP courses, the data on dual credit course completion appeared to have substantial limitations. A wide range of courses were flagged as dual credit in students' transcripts, including several courses clearly not completed for college credit (e.g., General Mathematics (Gr. 9-12), Consumer Math/Personal Finance (Gr. 9-12), and even Pre-Algebra (Gr. 6-8)). Consequently, the analysis was isolated to AP course data.

Across the four cohorts, overall, the vast majority of students did not complete an AP mathematics course. Of those Grade 8 students who completed Algebra I or higher, across the cohorts, only 11.7% completed one AP mathematics course during high school; 2.2% completed two and 0.3% completed three AP mathematics courses.

For the 2011 (7906 students) cohort, 23.1% completed one AP mathematics course during high school; 4.8% completed two, 0.5% completed three and 0.1% completed four AP mathematics courses. For the 2012 (10,513 students) cohort, 18.1% completed one AP mathematics course during high school; 3.8% completed two and 0.5% completed three AP mathematics courses. However, due to the limited time frame of transcript data, there was a significant shift during the 2013 (9621 students) and 2014 (9167 students) cohorts. For the 2013 cohort, 6.1% completed one AP mathematics course during high school; 0.4% completed two and 0.1% completed three AP mathematics courses.  For the 2014 cohort, 0.5% completed one AP mathematics course during high school; 0.1% completed two AP mathematics courses.

There was no statistical association between gender and completion of AP mathematics courses for the student population overall. The completion rate for both males and females were similar.

There was a statistical association between race and completion of AP mathematics courses ($\chi^2 = 906.7$, $p < .001$). With those students identifying as Hispanic/Latino, Black/African American and American Indian/Alaskan Native having the lowest completion percentages. For those students identifying as Hispanic/Latino, 7.6% completed one AP mathematics course during high school; 1.3% completed two and 0.1% completed three AP mathematics courses. For those students identifying as Black/African American, 6.4% completed one AP mathematics course during high school; 1.8% completed two and 0.4% completed three AP mathematics courses. For those students identifying as American Indian/Alaskan Native, 5.9% completed one AP mathematics course during high school, while only 0.8% completed two AP courses. Those students identifying as Hawaiian/Other Pacific Islander, Asian, and White/Caucasian, had a percentage slightly above the overall average for those students who completed one AP mathematics course in high school; 19%, 17%, and 12.2%, respectively.

There was a statistical association between SES status and completion of AP mathematics courses ($\chi^2 = 332.3$, $p < .001$). For those students who qualified for FRL status, 8.3% completed one AP mathematics course during high school; 1.4% completed two and 0.1% completed three AP mathematics courses. For high SES students, 13.7%

completed one AP mathematics course during high school; 2.7% completed two and 0.3% completed three AP mathematics courses.

There was a statistical association between special education status and completion of AP mathematics courses ($\chi^2$= 117.1, p < .001). For those students who qualified for special education services, 3.0% completed one AP mathematics course during high school, and 0.3% completed two AP courses. Of those students who did not qualify for special education services, 12.0% completed one AP mathematics course during high school; 2.3% completed two and 0.3% completed three AP mathematics courses.

There was a statistical association between EL status and completion of AP mathematics courses ($\chi^2$ = 34.96, p < .001). For those students who qualified for EL services, 3.4% completed one AP mathematics course during high school; 0.9% completed two and 0.5% completed three AP courses. Of those students who did not qualify for EL services, 11.8% completed one AP mathematics course during high school; 2.2% completed two and 0.3% completed three AP mathematics courses.

# CHAPTER FIVE: DISCUSSION

Without the ability to match Idaho students to Idaho's state funded advanced opportunities, a mathematics achievement marker was chosen; those Grade 8 students who had completed Algebra I or higher during the first four years of advanced opportunities implementation, 2011-2014. Student demographic data and mathematics coursework data were matched to those students identified, in order to determine if students placed on an early advanced pathway potentially scored at an advanced level on the state's student achievement assessment and/or remained on an advanced mathematics pathway over their high school career, both indicators of post-secondary and/or career success.

During the 2011-2012 through the 2014-2015 school year, approximately 41% of the Grade 8 student population, for each school year, were considered on an advanced mathematics path. From Grade 8 to 12, only 38.4% of students who were on an advanced mathematics path in Grade 8 remained. The percentage of those students on an advanced mathematics track in Grade 8 immediately dropped by the students' Grade 9 year, to just over fifty percent of those students originally identified. This suggests an over generalization of those students ready to persist in an advanced pathway in mathematics, especially since 43.5% of those students originally identified moved to an on-track path only after one year, with a small percentage moving to an even lower track. In Grade 10, the percentage of on-track students remaining in an advanced pathway dropped approximately another 1%; the shift occurred in an additional percentage of students moving from on-track status in mathematics to a low path (approximately 3.5%). This suggests that a percentage of those students who were not academically ready for an advanced mathematics path, did not pass on-track coursework in Grade 9, and were either retaking coursework in Grade 10 or moved to an even lower mathematics path. Grade 11 percentages saw a more significant drop in students on the advanced pathway, with just over a ten percent shift in students from the advanced path, to a slight 1% bump in those students on-track, suggesting that an additional sub-set of the original Grade 8 students identified struggled with Grade 10 advanced coursework and were moved to an on-track path in Grade 11. The number of students who moved to a low track continued to increase until Grade 12, where we see 33% of the original Grade 8 students moved to a low track, with only 38.4% remaining on the advanced track.

These findings suggest that an advanced mathematics path was an area of struggle for approximately two-thirds of those students originally identified in Grade 8 as being academically ready for an advanced path in mathematics. With approximately one-third of those students moving to a low mathematics path in Grade 12, and the largest percentage shift occurring from Grade 11 to 12, this suggests that Idaho's mathematics requirement for those students in their last year of high school may have had an effect on the courses students chose to take in their last year of high school. In order to ensure graduation and high GPA scores, students could plausibly have chosen to enroll in a mathematics course that is less academically challenging during their last year of high school.

With males and females being equally represented in an advanced math pathway by Grade 12, it suggests Idaho is succeeding in encouraging female students to pursue a rigorous mathematics path as equally well as males. While all races had a steady rate of decrease in students continuing on an advanced mathematics pathway, those students identifying as Black/African American, Hispanic/Latino, and American Indian/Alaskan Native saw an even greater decrease in student numbers. Part of the reason for the disparity may be because there was a low number of students from these races originally identified as ready for an advanced mathematics path in Grade 8. To increase representation across all races, students of minority groups need to be identified early on in middle school and provided with advancement opportunities. Students on FRL status saw an even greater drop in percentage of students remaining on an advanced mathematics pathway during their Grade 12 year, with 43.2% of the subset of students moving to a low mathematics pathway. This suggests that early supports through intervention need to be available for these students to remain on an advanced mathematics pathway.

Overall, it was determined through multiple tests, that Grade 8 ISAT scores are statistically associated with Grade 10 ISAT scores, suggesting that if Idaho would like a greater number of students who are on a mathematics pathway to be successful in continuing on such a path through high school, preparatory work needs to occur in those grades prior to Grade 8, where students are provided a strong background in foundational skills. Grade 8 ISAT scores were statistically associated with Grade 10 ISAT scores across all student demographics, except gender; i.e. across race, FRL status, as well as special education and EL status.

Over the four cohorts, the vast majority of students did not complete an AP mathematics course. Of those Grade 8 students who completed Algebra I or higher, across the cohorts, only 11.7% completed one AP mathematics course during high school; 2.2% completed two and 0.3% completed three AP mathematics courses.

## Limitations

A limitation in calculating percentages of students remaining on an advanced mathematics path year-over-year is the differences in the overall identified student population count from one year to the next. When students were first identified, the original population was that of 37,207 students across the four cohorts. By Grade 9, the population count dropped to 35,404 students; it further dropped to 34,278 students in Grade 10. A further drop in population counts occurred in Grades 11 and 12 because those students identified in the 2013 and 2014 cohorts have yet to complete high school.

With the inability to match students to dual credit coursework, and a large number of school districts not participating in AP coursework, AP completion percentages are not representational of the advanced mathematics population overall. Also, the percentages of AP completion are for mathematics courses only; with the number of students increasing that are participating in the Advanced Opportunities funding, the results suggest that a greater number of students are participating in dual credit or other advanced opportunities rather than AP courses, and that the increase may be in other content areas than mathematics.

## Future Research

In order to get a better idea of those students who are completing advanced mathematics paths, an FFP participation demographic needs to be created and used by districts for identification purposes. Dual credit completion needs to be evaluated to determine the protocol districts are using to identify students as completing dual credit coursework. With the current list of courses being identified by districts as being dual credit, it is clear that courses are being miscoded.

Once these two areas are addressed, future research can pinpoint differences in the group of students who participate in the Fast Forward (FFP) program and their counterpart, those who do not participate in the FFP program. The analysis will pinpoint more accurately overall numbers and provide clearer areas where improvement is needed.

# REFERENCES

2017 Idaho Legislature House Education Committee meeting. February 15, 2017. Advanced Opportunities Brief [Video file]. http://lso.legislature.idaho.gov/MediaArchive/ShowMediaByCommittee.do.

Adelman, C. (2006). The Toolbox Revisited: Paths to Degree Completion for HighSchool Through College. Retrieved from https://www2.ed.gov/rschstat/research/pubs/toolboxrevisit/index.html

Allensworth, E. M., Nomi, T. (2009). College-Preparatory Curriculum for All: The Consequences of Raising Mathematics Graduation Requirements on Students' Course Taking and Outcomes in Chicago. Retrieved from https://eric-ed-gov.libproxy.boisestate.edu/?id=ED524648

Attewell, P., & Domina, T. (2008). Raising the Bar: Curricular Intensity and Academic Performance. *Educational Evaluation and Policy Analysis*, *30*(1), 51-71.

Bloom, H. S., Ham, S., Melton, L. & O'Brien, J. (2001). Evaluating the Accelerated Schools Approach: A Look at Early Implementation and Impacts on Student Achievement in Eight Elementary Schools. Retrieved from https://eric-ed-gov.libproxy.boisestate.edu/?id=ED460971

Burris, C. C., Heubert, J. P., & Levin, H. M. (2004). Math Acceleration for All. *Educational Leadership*, *61*(5), 68.

Burris, C. C., Heubert, J. P., & Levin, H. M. (2006). Accelerating Mathematics Achievement Using Heterogeneous Grouping. *American Educational Research Journal*, *43*(1), 105-136.

Business-Higher Education Forum. (2005). A Commitment To America's Future: Responding to the Crisis in Mathematics & Science Education.

Champion, J. & Carney, M. (2017). Teacher Characteristics and Secondary Mathematics Achievement in Idaho: Brief Statistical Research Report. Prepared for the Idaho Board of Education. Provided by Dr. Joe Champion.

Clotfelter, C. T., Ladd, H. F., Vigdor, J. L. (. (2012). The Aftermath of Accelerating Algebra: Evidence from a District Policy Initiative. Working Paper 69. Retrieved from https://eric-ed-gov.libproxy.boisestate.edu/?id=ED529166

Domina, T. (2014). The Link Between Middle School Mathematics Course Placement and Achievement. *Child Development*, 85(5), 1948-1964/

Domina, T., Conley, A. & Farkas, G. (2009). The Link Between Educational Expectations and Effort in the College-for-all Era. *Sociology of Education,* 84(2),93-112.

Domina, T., McEachin, A., Penner, A., & Penner, E. (2015). Aiming High and FallingShort: California's Eighth-Grade Algebra-for-All Effort. *Educational Evaluation And Policy Analysis*, *37*(3), 275-295.

Domina, T., & Saldana, J. (2012). Does Raising the Bar Level the Playing Field?: Mathematics Curricular Intensification and Inequality in American High Schools, 1982-2004. *American Educational Research Journal*, *49*(4), 685-708.

Dougherty, S. M., Goodman, J. S., Hill, D. V., Litke, E. G., & Page, L. C. (2015). Middle School Math Acceleration and Equitable Access to Eighth-Grade Algebra: Evidence from the Wake County Public School System. *Educational Evaluation and Policy Analysis*, *37*(1), 80S-101S.

Durham, R. E. (2014). A Preliminary Examination of Baltimore Ingenuity Student Outcomes: Classes of 2008 and 2013. Retrieved from https://eric-ed-gov.libproxy.boisestate.edu/?id=ED553167

Gamoran, A., & Hannigan, E. C. (2000). Algebra for Everyone? Benefits of College-Preparatory Mathematics for Students with Diverse Abilities in Early Secondary School. *Educational Evaluation And Policy Analysis*, *22*(3), 241-54.

Hern, K. (2012). Acceleration across California: Shorter Pathways in Developmental English and Math. *Change: The Magazine Of Higher Learning*, *44*(3), 60-68.

Idaho State Department of Education. Advanced Opportunities. Brochure. Retrieved from http://www.sde.idaho.gov/student-engagement/advanced-ops/

Idaho Legislature. Title 33 Education. Idaho Statutes. Retrieved from https://legislature.idaho.gov/statutesrules/idstat/title33/.

Loveless, T. (2008). The Misplaced Math Student: Lost in Eighth-Grade Algebra. The 2008 Brown Center Report on American Education. Special Release. Retrieved from https://www.brookings.edu/research/the-misplaced-math-student-lost-in-eighth-grade-algebra/

JASP Team (2018). JASP (Version 0.8.5)[Computer software].

Ma, X. (2010). Effects of Early Acceleration of Students in Mathematics on Taking Advanced Mathematics Coursework in High School. *Investigations In Mathematics Learning*, *3*(1), 43-63.

Nomi, T. (2010). The Unintended Consequences of an Algebra-for-All Policy on High-Skill Students: The Effects on Instructional Organization and Students' Academic Outcomes. Retrieved from https://eric-ed-gov.libproxy.boisestate.edu/?id=ED512659

Rickles, J. H. (2013). Examining Heterogeneity in the Effect of Taking Algebra in Eighth Grade. Journal Of Educational Research, 106(4), 251-268.

Schiller, K. S., & Muller, C. (2003). Raising the Bar and Equity? Effects of State High School Graduation Requirements and Accountability Policies on Students' Mathematics Course Taking. *Educational Evaluation And Policy Analysis*, *25*(3), 299-318.

Siegler, R. S., Duncan, G. J., Davis-Kean, P. E., Duckworth, K., Claessens, A., Engel, M., & Meichu, C. (2012). Early Predictors of High School Mathematics Achievement. Retrieved from https://eric.ed.gov/?id=ED552898

Smith, J. B. (1996). Does an Extra Year Make Any Difference? The Impact of Early Access to Algebra on Long-Term Gains in Mathematics Achievement. *Educational Evaluation And Policy Analysis*, *18*(2), 141-53.

USDA Food and Nutrition Services Child Nutrition Programs. (2017). (1990). *Eligibility Manual for School Meals Determining and Verifying Eligibility* (Document No. SP36 CACFP15 SFSP11-2017). Retrieved from: https://www.fns.usda.gov/2017-edition-eligibility-manual-school-meals

Walston, J., McCarroll, J. C., & National Center for Education Statistics. (2010). Eighth-Grade Algebra: Findings from the Eighth-Grade Round of the Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K). Statistics in Brief. NCES 2010-016. Retrieved from https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2010016