5-2011

Critical Issues in Middle and Secondary Mathematics Placement: A Case Study

Morgan E. Summers
Utah State University

CRITICAL ISSUES IN MIDDLE AND SECONDARY MATHEMATICS PLACEMENT: A CASE STUDY

by

Morgan E. Summers

**Thesis submitted in partial fulfillment
of the requirements for the degree**

of

DEPARTMENTAL HONORS

in

**Mathematics Education
in the Department of Mathematics and Statistics**

Approved:

Thesis/Project Advisor Brynja Kohler	**Committee Member** Jim Cangelosi
Departmental Honors Advisor Dave Brown	**Director of Honors Program** Christie Fox

**UTAH STATE UNIVERSITY
Logan, UT**

Spring 2011

Abstract:

This qualitative research project focuses on the issues facing middle and secondary mathematics placement through an extensive literature review as well as a case study of a local school district. As students move from elementary school to middle and secondary schools, they are placed into classes that appear to be based on ability. One of the driving questions of this project is how is this ability level determined? Through an in-depth look at one school district, it is found that a primary source of information is both norm-referenced and criterion-referenced assessments given to students in fifth and eighth grades. In this school district, parents and students, with the help of guidance counselors, are the ones who make the final decisions. The role of students' current mathematics teachers seem to be minimized, instead focusing on data such as assessment scores and previous mathematics grades. An analysis of the strengths and weaknesses of this method is included. An original goal of this project was to provide the cooperating school district with not only an analysis of their status quo, but research-based recommendations on improving their status quo. However, with the 2010 adoption of the Common Core Standards, these recommendations have become unnecessary so instead a look at how these standards and benchmarks will impact the students in this school district will be included.

This thesis is dedicated to the many friends and mentors who have helped me learn that I am capable of more than I ever thought possible.

Acknowledgements go first to the faculty, staff, and administration of City School District for their willingness to participate and especially for their timely responses to my many requests. Secondly, I would like to acknowledge and thank the staff of the Honors Office—Dr. Christie Fox, Amber Summers-Graham, and Beth Heaton—for their support, encouragement, and guidance through not only this process, but also through my entire undergraduate career. Without them, I would not be where I am at today, nor would I be the person that I am today.

Table of Contents

List of Figures

Introduction:

As mathematics teachers, we want to create an environment for our students in which they are adequately challenged, yet allow them to experience success. One of the first ways to do this is to make sure students are placed into a mathematics course whose curriculum is within a student's zone of proximal development. How do we do that? How do we place students into mathematics courses? How can we ensure that the methods we use are accurately placing students? These are but some of the driving questions that motivated this project.

In August of 2010, the Utah State Board of Education unanimously adopted the Common Core Standards. These standards were a state-led initiative, led by the Council of Chief State School Officers (CCSSO) and the National Governors Association Center for Best Practices (NGA Center). While these standards span across many content areas, this paper will focus specifically on the mathematics content area.

Methodologies:

Because placement methods can differ so much from state to state and district to district, to gather the in-depth data and analyses needed to attempt to answer the guiding questions, this study utilized a case study approach, looking in depth at a local school district and seeing how the data collected compares to the current literature. However, with the adoption of the Common Core Standards, the focus shifted toward researching how these standards will impact City School District (CSD), as the implementation of these standards will begin in the upcoming school year.

In order to do this, first a review of the current literature was obtained. Following that, interviews were conducted with teachers and guidance counselors of CSD to gain an understanding of their placement practices, and the strengths and weaknesses of their status quo.

After that, an understanding of the Mathematics Common Core Standards, and the plan Utah developed for implementation, was developed through further reading. This allows a discussion of how these Common Core Standards, and the implementation, will possibly impact CSD.

Review of the Literature:

Boaler, Wiliam, and Zevenbergen observe that "Most students want to be successful at school, not least to avoid conflict with parents, but they also need to negotiate a way of being successful that does not alienate them from groups with whom they feel affinity." (p. 10) This observation is important to note as not only do we as teachers want our students to be successful in our classes, but our students themselves want to be successful, however are balancing a tightrope in terms of developing their identity of who they are. Their peers play an important part of this, and so a students wishes to be placed in particular mathematics classes may be coming from their fear of failure or desire for success, but also may come from their want and need to be accepted among their peers. While much of the research and literature may be focused on placement from a parent or school perspective, it is important to remember that students have motivations and desires that go beyond the desire to learn mathematics.

In 2005, the ACT, the not-for-profit organization which administers the college entrance exam of the same name, issued a Policy Report entitled "College Readiness Begins in Middle School." A common theme of this article is that students who take a more rigorous academic curriculum—one that begins in middle school—are better prepared than their peers for postsecondary education. Specifically using Algebra I and mathematics curriculum as an example, they elaborate that taking Algebra I in middle school allows students to take advanced classes in high school. It continues that, "students in higher-level courses are likely to obtain information about postsecondary opportunities and are likely to apply to a four-year college." (p. 4) In this way, students who are placed in accelerated or advanced mathematics courses following elementary school are better prepared for the postsecondary education of their choice later on in life. This placement decision is not one that should be taken lightly because of these implications. However, all too often, the decision is made without a sufficient understanding of these long-lasting consequences.

In their study, the ACT shows that parental involvement is critical in helping students to determine courses and programs of study. They find that 67% of students surveyed found their mother or other female guardian very helpful, and 25% found them a little helpful. Continuing on, 50% found their father or male guardian very helpful, and 34% found them a little helpful. (p.11) With the significant influence that parents and guardians have, it is important that they be informed of prerequisites for the postsecondary education their student desires. However, as the study continues, "Although their parents were very helpful in

course selection, many students recognized that their parents had limited knowledge and information about courses." (p. 11) They continue on to point out that many parents are most concerned that their student fulfill high school graduation requirements, and often just assume that these requirements will adequately prepare their student for college or other postsecondary education.

It has long been noted that students who come from higher socioeconomic classes tend to be placed in accelerated and advanced courses more often than their peers who come from lower socioeconomic classes. In his 2001 article, "Do Increased Levels of Parental Involvement Account for Social Class Differences in Track Placement?" Sean Kelly attempts to look at the whys of this documented observation. In this, he finds a positive correlation between parental involvement, and the level of education they have. This makes sense for several reasons. One in particular being that parents who have experienced the rigors of collegiate coursework know that the minimum high school graduation rates are simply not sufficient to prepare their student for postsecondary education, and therefore these parents intervene to ensure their student has a rigorous college-preparatory curriculum.

Background Data:

Figures 1 and 2 show the Mathematics Annual Yearly Progress (AYP) for the Middle School and High School of City School District, respectively. This not only shows the demographics of this district—mostly Caucasian with a rising number of Hispanic students—but shows the status quo in terms of whether or not each of the

groups were able to meet their designated AYP. This is determined based on the state end-of-level assessments.

Group	Mathematics (GOAL[3] = 45%) Participation N	Participation %	2010 Test Scores N	2010 Test Scores %	2009 Test Scores N	2009 Test Scores %	Group OK?	Attendance Rate %	Graduation Rate %
All Students	1258	99	1193	74	1090	72	Yes	95	
Asian	40	100	38	71	34	76	Yes	96	
African American	21	N<40	21	62	12	50	Yes	N<40	
American Indian	18	N<40	16	56	15	47	Yes	N<40	
Caucasian	834	99	790	83	757	81	Yes	95	
Hispanic	332	100	315	52	265	48	Yes	96	
Pacific Islander	13	N<40	13	77	7	N<10	Yes	N<40	
Economically Disadvantaged	695	99	649	64	537	60	Yes	94	
Limited English Proficient	143	100	142	30	88	25	Yes*	96	
Students with Disabilities	161	99	150	46	137	42	Yes	94	

FIGURE 1

Group	Mathematics (GOAL[3] = 40%) Participation N	Participation %	2010 Test Scores N	2010 Test Scores %	2009 Test Scores N	2009 Test Scores %	Group OK?	Attendance Rate %	Graduation Rate %
All Students	150	97	136	58	119	42	Yes	94	99
Asian	3	N<40	3	N<10	1	N<10	Yes	95	N<40
African American	6	N<40	4	N<10	1	N<10	Yes	N<40	N<40
American Indian	5	N<40	4	N<10	0	N<10	Yes	N<40	N<40
Caucasian	83	98	78	68	90	48	Yes	95	100
Hispanic	50	98	44	39	26	15	Yes*	93	98
Pacific Islander	3	N<40	3	N<10	1	N<10	Yes	N<40	N<40
Economically Disadvantaged	82	98	74	49	49	37	Yes	93	99
Limited English Proficient	13	N<40	12	33	9	N<10	Yes*	92	N<40
Students with Disabilities	18	N<40	16	69	21	38	Yes	92	N<40

FIGURE 2

Data Analyses and Discussion:

In order to understand how the Common Core Standards will affect CSD, it is first important the status quo. In the fall of their fifth grade year, all students in Utah take the Iowa Test of Basic Skills (ITBS), including students in CSD. According the Utah State Office of Education, "This standardized test is administered in order to evaluate the achievement of Utah students in relation to the achievement of students across the United States." It is the individual results of the mathematics portion of this test that determine the placement of students in LCSD into mathematics classes as they make the transition from elementary school (Kindergarten through 5th grades) to middle school (6th through 8th grades).

When students in CSD leave elementary school, the majority of them will take Math 6, however based on student results of the ITBS may skip Math 6 and take Pre-Algebra instead. Below is a chart (Figure 3) summarizing the progression of students from one math class to the next.

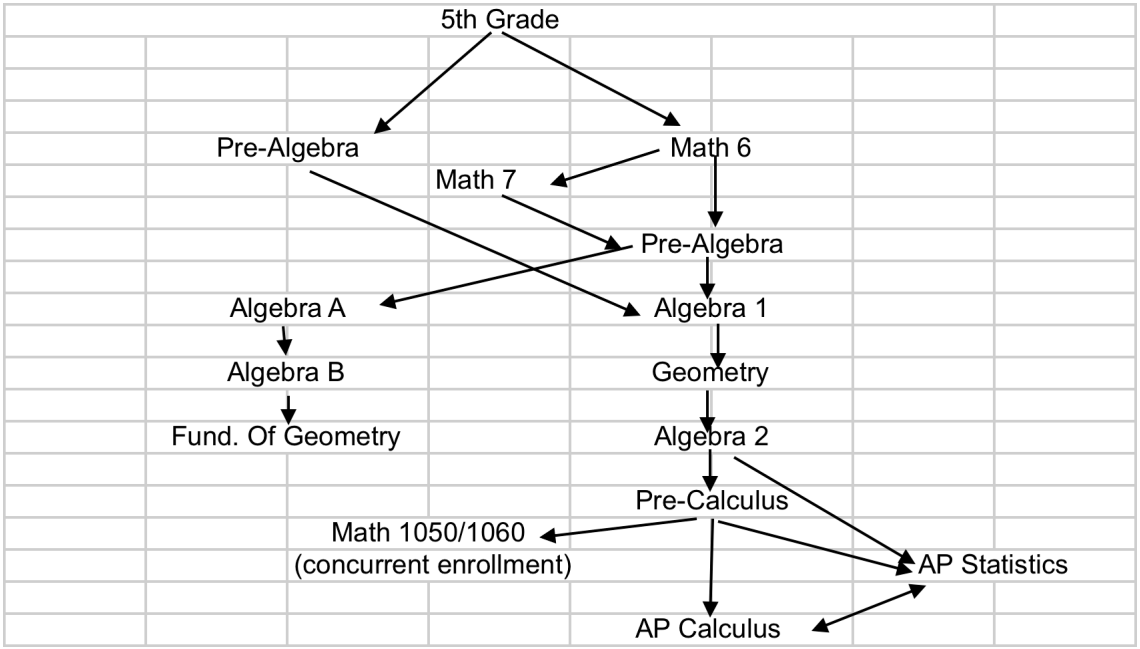

FIGURE 3

In order to understand the impact of this method of placement, it is necessary to understand what the ITBS is and what it was designed for. The ITBS is not a single test. Instead it is a battery of assessments that cover such concepts as reading comprehension, vocabulary, mathematical estimation, and mathematical calculation. There are 14 levels of the tests, with levels 5-8 appropriate for students in Kindergarten through 2nd grades, and levels 9-14 appropriate for students in 3rd through 8th grades.

The University of Iowa College of Education, who design and produce the ITBS, list seven of the appropriate uses that levels 9-14 of the ITBS was designed for. One of these deemed appropriate uses is that the ITBS can "identify areas of relative strength and weakness in the performances of groups (e.g., classes), which may have implications for curriculum change—either in content or emphasis—as well as for change in instructional procedures." The emphasis here is that the ITBS is appropriate to determine strengths and weaknesses of *groups*, not *individuals*. In the next section, there is a list of inappropriate uses of the ITBS, and the first one states that the ITBS is not designed "to select students for special instructional programs."

It can be argued that using an individual student's ITBS score to determine placement, it is using the test incorrectly, as students who begin sixth grade in Pre-Algebra are able to take both AP Statistics and AP Calculus, whereas their Math 6 peers are only able to take one or the other, if any, therefore taking Pre-Algebra in sixth grade could be a "special instructional program."

However, the issue is more complex than that, as it goes on to clarify that "test scores can contribute important information to decisions about who needs remediation and who might be best included in programs for gifted and talented students." However, the ITBS should not be the *only* factor, so if teachers and guidance counselors are using teacher observations and other factors in their decision, then it clearly falls within the acceptable uses of the ITBS. But, as there is little to no opportunity to move ahead once that initial placement is made, it begs the question—should a standardized test administered in the fall of a student's fifth grade year weigh so heavily on the rest of that student's schooling?

The Common Core Curriculum, seems, at first, the solution to this question. Backing up a moment, it is first important to understand how the Common Core differs from the status quo. As is evidenced in Figure 3, currently mathematics is separated into various sub-disciplines, and students focus on one sub-discipline (e.g., Algebra) at a time. In the Common Core, all students will proceed from one class to the next, as dictated by grade level, and the sub-disciplines of mathematics (Algebra, Geometry, etc.) will be integrated across the entire series of courses. Figure 4 shows the course sequencing, as understood by the way the Common Core is portrayed. In this model, no placement

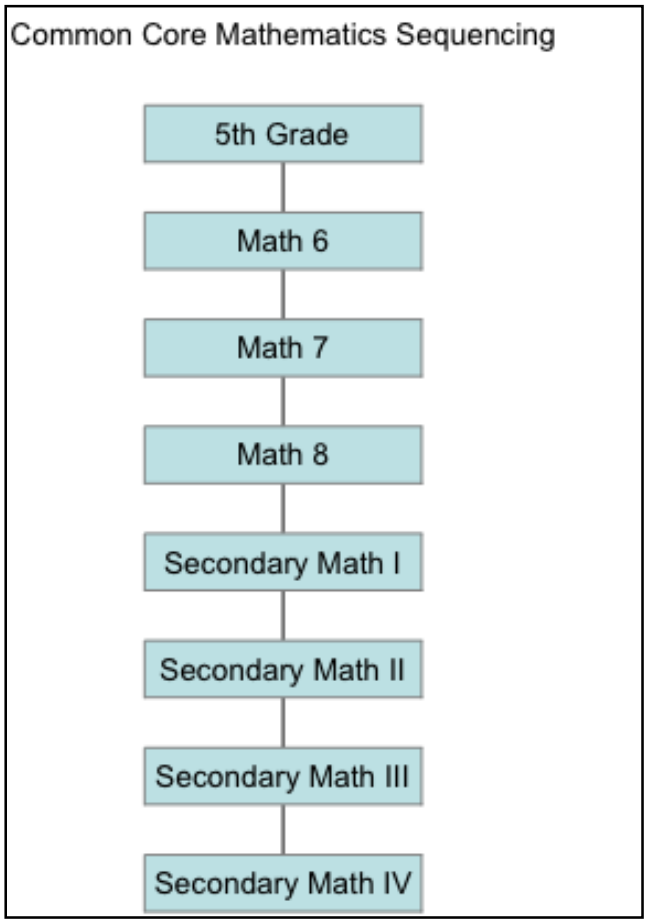

FIGURE 4

decision is ever made, thereby eliminating the critical issues brought up when such a decision is made.

However, according to the Utah State Office of Education's Suggested Course Progression for the new Common Core Standards, there will be an "Honors" track of Common Core Mathematics classes. This track of Common Core classes will include the Trigonometry necessary for success in a Calculus course (such as AP Calculus) in the student's senior year or in postsecondary studies. This means that a placement decision will still be made, and that this study is not only warranted, but is also still relevant to the faculty, staff, administration, and students of CSD. Who will get to take these "Honors" math classes and how will it be decided? Will the ITBS still be used as a deciding factor, or will another method be used?

As of right now, a lot is unknown. In a proposed course sequencing document produced by the Utah State Office of Education in November 2010, is looks as if the placement decision will now no longer happen as students transition from elementary into middle school, instead, that decision will be made as students transition from middle school into high school. The sequencing, as understood from this document can be seen in Figure 5.

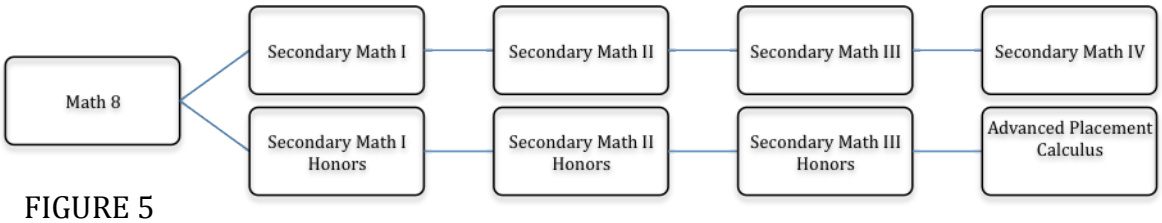

FIGURE 5

Another assessment taken by students in CSD is the Explore test. Students take this test during their eighth grade year. This test is given by the ACT and is

composed of four sections—Mathematics, Reading, English, and Science. This test is designed to show students how they compare to other eighth and ninth graders nationwide who also take this test. Some may think of this assessment as a middle-school version of the ACT college-entrance exam. In some ways, it is. It covers the same four sections as the ACT.

It would make sense that this Explore test would now be the one used to determine placement in this Common Core model. Why? According to the ACT, "We provided expansive longitudinal data on academic achievement and college readiness to determine what knowledge and skills should be included in the standards." In other words, the ACT had a stake in the adoption of these standards and will make sure that their product (their assessments such as the Explore test) fit under this new model. ACT has even produced a three hundred page document that shows how their assessments align with the Common Core Standards. This ensures that ACT's products will still be applicable.

In speaking with teachers at CSD about this proposed change, several expressed concern over having their more advanced students in the same class as their struggling peers. They worry that this caters so much to the "average" student, and keeps the more advanced students from progressing to their full potential, and leaves the students who are struggling behind—and keeps them behind.

In the status quo, if students fail a course, or perform poorly, they are able to simply re-take the same course the next year. With the changes, a student who fails seventh grade math will be moved to eighth grade math simply because that student, chronologically, is now in the eighth grade.

One concern of the status quo brought up in interviews with counselors of the High School of CSD, is the fact that students are able to move forward with simply a passing grade—a D minus in this district. Does a D minus really mean that a student has mastered enough content to be successful in a subsequent course? Especially considering the broad range of grading and assessment activities that happen from course to course, and teacher to teacher, a D minus simply means the student is able to receive academic credit for their coursework. It says nothing of their progression in their mathematical ability and talent. However, if a student receives credit for a mathematics course, and then chooses to retake that same course for whatever the reason, they can only qualify for elective credit—the repeat year does not count toward mathematics credits needed for high school graduation. This discourages the students that could benefit from retaking a course from doing just that—and this practice sets students up to struggle in the next course as they do not have the necessary grasp on the prerequisite material. This is a recognized flaw in the status quo. If this system were to continue, a revision in this policy would be recommended.

However, the focus has shifted from the status quo to the Common Core. The question of what kind of support will be provided for struggling students continues to be at the forefront. Because, as mentioned previously, if a student is not successful during their seventh grade year, they will simply move on to eighth grade math because that is what comes next. If there is a need for remediation, how and when can that occur? And what will that remediation look like? How will students, teachers, and parents respond?

The Common Core Initiative encourages practices consistent with the Response to Intervention (RTI) model. They encourage strategies such as after school tutoring, a "math support" class held during the day, and summer mathematics instruction. (p. 5) While some may question the efficacy of these methods, that is not the emphasis of this paper, nor the intent of this author to engage in this debate. However, the point is that the Common Core Initiative does, indeed, recognize the need for remediation, and includes ideas for how that remediation can occur under their model.

It is also of note that it is not the intent of the Common Core Initiative to hold students from reaching their potential, or leave students behind. As stated, "Watered-down courses which leave students uninspired to learn, unable to catch up to their peers and unready for success in postsecondary courses or for entry into many skilled professions upon graduation from high school are neither necessary nor desirable." (p. 5) The overarching goal of this Initiative is to prepare students to either enter the workforce with necessary skills, or to have the foundation to expand their talent for mathematics as they enter postsecondary education.

The next question that comes up, is how can the efficacy of placement practices be measured? This question is more difficult, as it is most simply answered with, "It depends on whom you ask!" If posed to a teacher, the response elicited would probably include descriptions of student behavior and achievement. For example, they may talk of students who are not bored in class (from knowing the material already), and don't act out because they don't understand the material. (They may act out because they are teenagers whose emotional, physical, social, and

mental development are out of control, but that is beside the point.) They would also continue on that students are able to experience success on the learning tasks presented to them in the course.

If you were to ask a student, their response would probably include details such as, "I just get it!" Noticeably absent will be the complaints of math being "just too hard" or something that they cannot succeed at. Why? They will be experiencing some degree of success in their mathematics course. Will math become their most favorite subject to study? Probably not. However, they will at least gain the confidence that they may not love the subject matter, but they can at least do it.

Another group that would provide a differing opinion to the same answer would be administrators and politicians. Their answers would demand some type of quantitative data—usually in the form of test scores. One of the main assessments looked at in the state of Utah is the Core Criterion Referenced Test, known simply as the CRT. These are the end of level exams given to students in Mathematics, Science, and Language Arts. These exams, as their name would indicate, are criterion referenced; meaning that they are based on a very specific set of standards and objectives and can only be interpreted in this limited domain. For these CRT's, the standards and objects to which they are designed are the standards, benchmarks, and objectives of the Utah Core Curriculum. While scores on these assessments can be used to generally determine if a student is successful in a particular class—to some extent the scores also reflect the degree that a particular teacher covered the objectives of the Core Curriculum, so there is some caution in

extrapolating test score data to determine appropriate mathematics course placement, though they are related.

With the Common Core, CRT scores will most likely decrease as the implementation is made, and the assessment catches up with the new standards. Does this mean that the Common Core will be ineffective? Not necessarily. Will this mean that students are less proficient in mathematics? Of course not. According to the Utah State Office of Education, the CRT assessments that will be in line with the Common Core will not be operational until the 2014-2015 school year. This means that until that time, the CRT assessments that are currently in use will still be in use. And it is for that reason that the CRT scores will initially decline—the standards, objectives, and benchmarks that are being taught will not necessarily align with the standards, objectives, and benchmarks on the current CRTs. Will they be similar? Yes. The Common Core is teaching the same mathematical content as the current core curriculum, it differs in the structure of how that content is delivered. It is this similarity that will allow students, while taking the Common Core classes, to experience some degree of success on the old CRT assessments. Only time will tell if after the initial drop in test scores, the data begin to raise.

Conclusion:

The emphasis of this project is that middle and secondary mathematics placement matters. The decisions made in regards to math classes taken affect not only the student's secondary education, but also affect their postsecondary education, and ability to enter a skilled workforce. With an ever-increasing level of technological proficiency needed for success in society, the need for an

understanding of the basic principles of logic, reasoning, and procedure that mathematics courses teach becomes critical. Not only as teachers do we want our students to be successful, but our students need to have these skills in order to reach the potential that we see in them. If students are not adequately placed into appropriate mathematics courses they will either not be able to experience success, or will not be stuck, unable to expand their talent for mathematics. Neither situation is one that we, as teachers, want for our students, as we want our students to experience the greatest degree of success possible, and through doing that increase their talent for not only mathematics, but critical thinking as well—as critical thinking skills are one of the key reasons that studying mathematics is worthwhile to students across all disciplines.

What does this mean for CSD? With a decision that weighs this heavily on a student's education, the overall message is that more than one data point should be taken into consideration when determining mathematics course placement in the middle and secondary levels. While the ITBS or the Explore test can be used as a factor in determining placement, they should be the sole factor. Other factors such as teacher recommendations—which would be based on past performance as well as student behavior in the classroom—and the voice of the student and their parents should be taken into consideration.

Only time will be able to tell the effectiveness of the Common Core in CSD, and of the implications it will have for mathematics placement decisions. Whatever the structure or the curriculum may be, however, the goal of student success will always be at the forefront for the faculty, staff, and administration of CSD.

References:

ACSD (2011). Common Core Standards Adoption by State. Retrieved from http://www.ascd.org/public-policy/common-core-standards.aspx

ACT (2011). The Explore Test. Retrieved from http://actstudent.org/explore/tests/index.html

ACT (2011). ACT and the Common Core State Standards Initiatives. Retrieved from http://www.act.org/commoncore/

Boaler, J. , William, D. , & Zevenbergen, R. . (2000). The construction of identity in secondary mathematics education. *Education Resources Information Center,* Retrieved from http://eric.ed.gov/ERICWebPortal/detail?accno=ED482654

Burney, V. H. . (2010). High achievement on advanced placement exams: the relationship of school-level contextual factors to performance. *Gifted Child Quarterly,* Retrieved fromhttp://gcq.sagepub.com/content/54/2/116.full.pdf+html

Common Core State Standards Initiative (2010) Appendix A: Designing high school mathematics classes on the common core state standards

Kelly, S. (2001). Do increased levels of parental involvement account for social class differences in track placement?. *Education Resources Information Center, 1-26.*

National Governor's Association, Council of Chief State School Officers (2010). Frequently Asked Questions. Retrieved from http://www.corestandards.org/frequently-asked-questions

Useem E. L., (1991) Student selection into course sequences, *Journal of Research on Adolescence. 232-250.*

Utah State Board of Education (2010, August 6). Meeting of the Utah State Board of Education

Utah State Office of Education (2010) USOE—Iowa. Retrieved from http://www.schools.utah.gov/assessment/info_iowa.aspx

Utah State Office of Education (2010, November 17), USOE Suggested course implementation schedule. Retrieved from http://www.schools.utah.gov/core/DOCS/Student-Course-Progressions.aspx

University of Iowa College of Education (n.d.) The Iowa Test of Basic Skills. Retrieved from http://www.education.uiowa.edu/itp/itbs/Default.aspx

University of Iowa College of Education (n.d.) Purposes of the ITBS test batteries, Levels 9-14. Retrieved from http://www.education.uiowa.edu/itp/itbs/itbs_about_9-14_prp.aspx

Wimberly G. L., Noeth R. J., (2005) College readiness begins in middle school. *ACT Policy Report*

Author's Biography: Morgan Summers was born and raised in Ogden, Utah. After a mostly carefree childhood, she graduated from Weber High School in 2007. Following in her father's footsteps, she enrolled at Utah State University that fall—pursing a degree in Mathematics Education, with a minor in Speech Communication Teaching. A member of the National Society of Collegiate Scholars, Morgan excelled during her time as an Aggie. However, all good things must come to an end, and she graduated with her Bachelor of Science degree in May 2011, with both University and Departmental Honors. Morgan is attending Ball State University in Muncie, Indiana come Fall 2011, working toward a Master's degree in Organizational and Professional Communications Development. She was able to receive a full assistantship due to her stellar performance as an undergraduate. Upon her graduation from Ball State in 2013, Morgan plans on teaching high school mathematics and being a fierce advocate for mathematics education research.