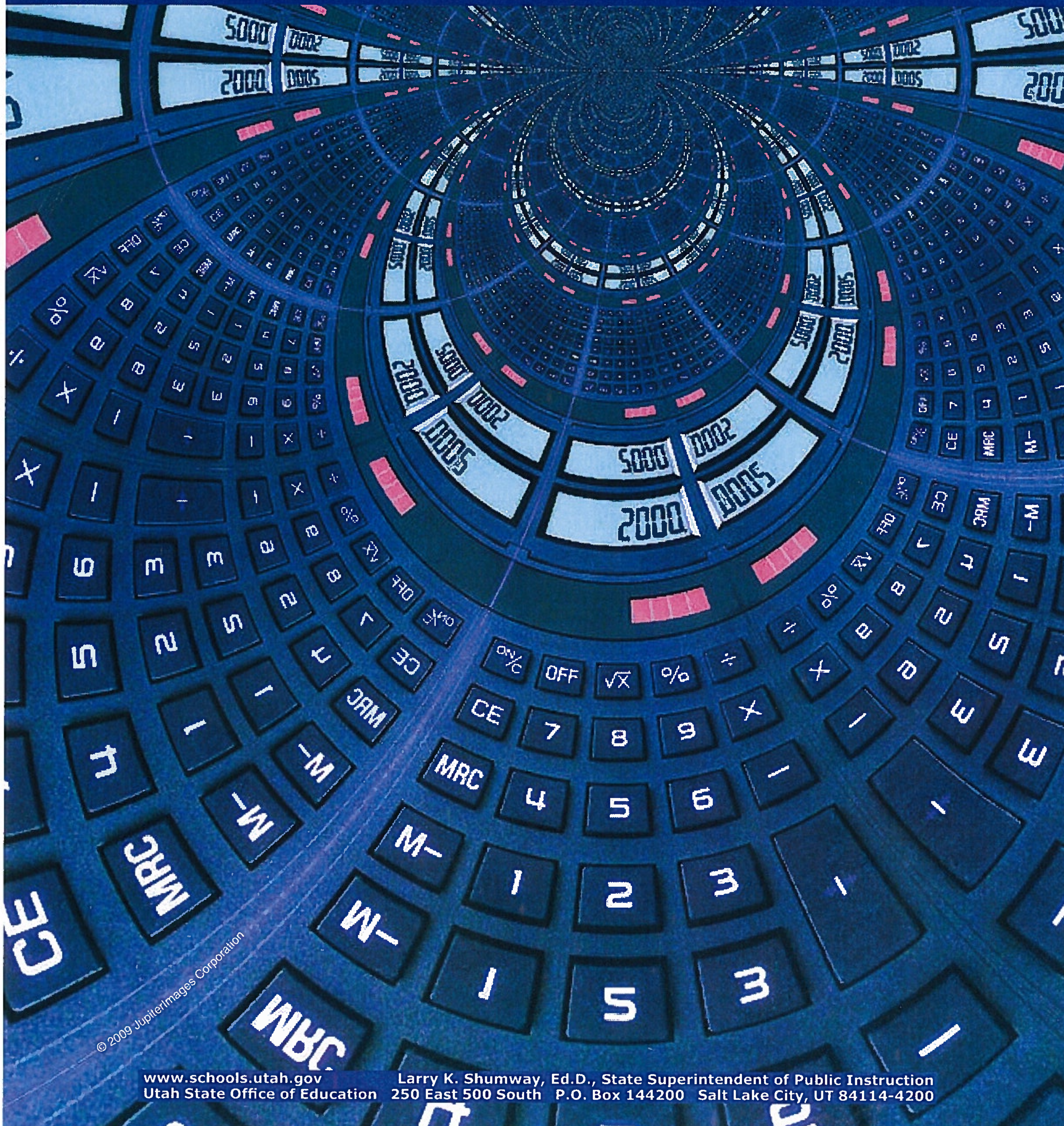
Utah State Office of Education
MATHEMATICS STEERING COMMITTEE

IS UTAH MATH READY?



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Utah State Office of Education Mathematics Steering Committee

Utah needs high-school graduates who are mathematically well prepared to thrive in today's high-tech, complex, and competitive world. The purpose of Utah's Mathematics Steering Committee was to provide recommendations to the Utah State Board of Education that would ensure proficiency in mathematics for all Utah children. The committee was assigned to engage stakeholders in defining effective mathematics education for Utah students.

The Importance of Mathematics

Utah's educators, mathematicians, and business and government leaders have a strong commitment to improving mathematics instruction. They recognize the economic and civic importance of a populace with strong numeracy skills, including a strong understanding of numbers, geometry, and data, as well as the ability to compute, to solve problems, and to represent, communicate, and apply mathematical ideas. Furthermore, they recognize the important role mathematics plays in developing attitudes of persistence toward problem-solving and appreciation for mathematics in many venues, including career applications, decision-making, and creative thinking.

It is the purpose of mathematics education in Utah to ensure student literacy in mathematics, provide high quality instruction, establish high quality and relevant curricula and use effective assessment. The steering committee recognizes the necessity of strong, effective mathematics preparation to develop solid college- and job-ready skills for graduates who will be prepared to play a role in improving and sustaining a strong economy while reaping the economic rewards and personal satisfaction found in the pursuit of their chosen career.

Utah's future depends upon the skills of its citizens. Mathematics skills and knowledge are strongly correlated with career and economic success (NMAP, 2008). Mathematics courses teach children to think logically, solve problems, and communicate technical information precisely. Mathematics skills are used in personal as well as professional situations. Adults must be able to use mathematics to monitor personal spending and make financial decisions involving, mathematics such as choosing an appropriate mortgage or loan structure. Homeowners use mathematics to calculate paint costs, and consumers use it to make wise purchasing decisions. Mathematics is used by nurses calculating dosages, analysts designing networks, and financial advisors working with clients. It is used by engineers designing structures, business executives working with large budgets, and janitors mixing chemicals.

Mathematics proficiency will be even more necessary in the future. Industries such as scientific and technical consulting, medical services, and computer systems design are among those projected to have the largest wage and salary employment growth through 2016 (Bureau of Labor Statistics, 2007). Comparatively, industries such as printing, manufacturing, and department stores will show declines of up to 58 percent. In Utah, “five-star” occupations include biomedical engineers, computer and information systems managers, cardiovascular technologists, and nurses. Industrial growth in health care and computer and mathematical areas is greater than in other areas (Utah Department of Workforce Services, 2009). In general, mathematics-intensive careers such as nursing and other health care fields, computer software engineers, and systems analysts show the greatest promise for increased growth. It is imperative that Utah schools prepare children mathematically to become participants in an increasingly technical and global economy.

Is Utah Math Ready?

Utah students must be prepared to enter the 21st century workforce. The Mathematics Steering Committee examined the current state of mathematics education in Utah through analysis of current data, a review of Utah’s instruction, curriculum and assessment programs, mathematics education research, and professional opinions based on economic and social realities. The results are discussed below.

Current Data

Test Data

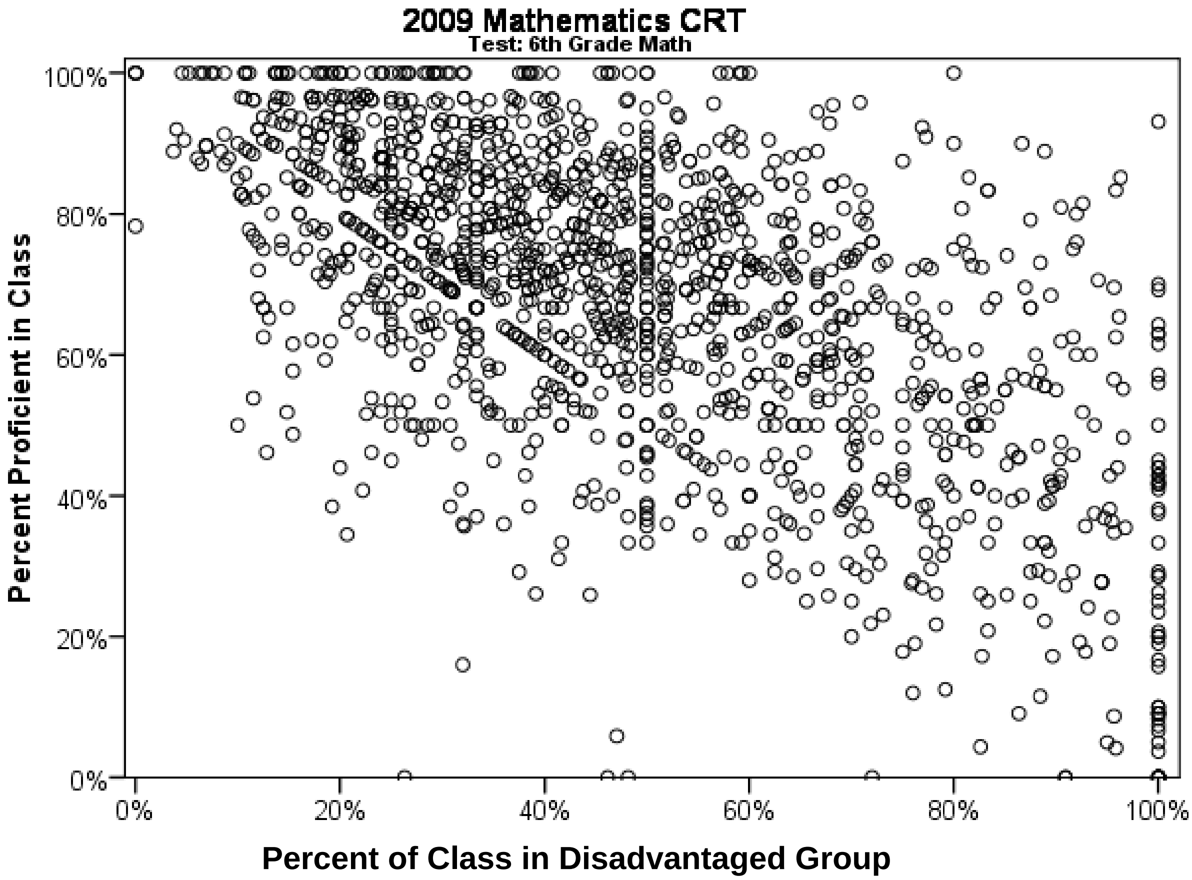
Utah Criterion-Referenced Tests

In 2009, 63 percent of all Utah students showed proficiency on mathematics criterion-referenced tests (CRTs) given at the conclusion of instruction. Proficiency rates for American Indians, Black, Hispanic, and limited English proficient students were less than 50 percent.

	2009 Math CRT % Proficient, Statewide by Test							
	Asian	Black	Caucasian	Hispanic	American Indian	Pacific Islander	Total	Title III ELL
2nd Grade Math	80%	54%	83%	54%	54%	65%	78%	51%
3rd Grade Math	74%	45%	76%	46%	42%	55%	70%	33%
4th Grade Math	78%	50%	78%	50%	48%	60%	73%	35%
5th Grade Math	79%	52%	77%	52%	48%	67%	73%	36%
6th Grade Math	76%	43%	73%	44%	42%	56%	68%	27%
7th Grade Math	66%	43%	72%	46%	48%	64%	66%	32%
Pre-Algebra	70%	42%	72%	40%	39%	53%	66%	22%
Algebra I	55%	29%	57%	25%	24%	32%	51%	12%
Geometry	71%	40%	68%	36%	37%	40%	63%	19%
All Math	66%	43%	68%	42%	40%	51%	63%	32%
Excludes tests marked as Absent, Excused, Unknown Student, Withdrawn, Refused to Test, Private/Home Schooled, or UAA.								

In most grades, as percentages of disadvantaged students (based on poverty, language barriers, or minority status) increase, mathematics proficiency decreases. However, not all disadvantaged classrooms experience low levels of proficiency and not all classrooms without disadvantaged students achieve high levels of proficiency. Each data point on the graph below represents the classroom rate of sixth grade mathematics proficiency as compared to disadvantaged status. The data points in the upper right quadrant illustrate that it is possible for disadvantaged students to achieve at high levels, given quality instruction and skilled teachers.

Class-Level Proficiency Rates for Sixth Grade Mathematics (2009)

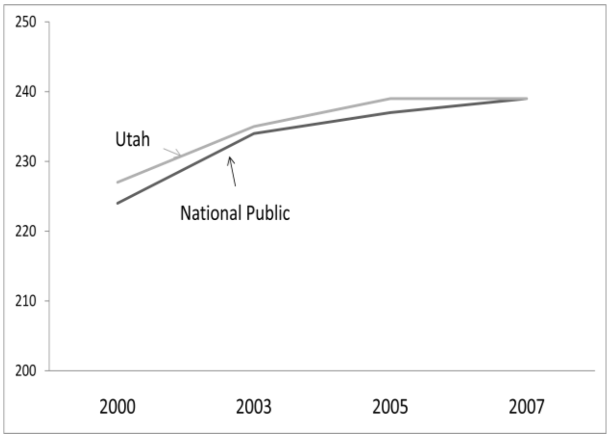


Excludes UAA tests, tests that were modified and 2008 tests taken in 2009.
Each circle represents a class (unique teacher, section, school). Excludes classes that reported less than 10 tests or more than 40 tests.

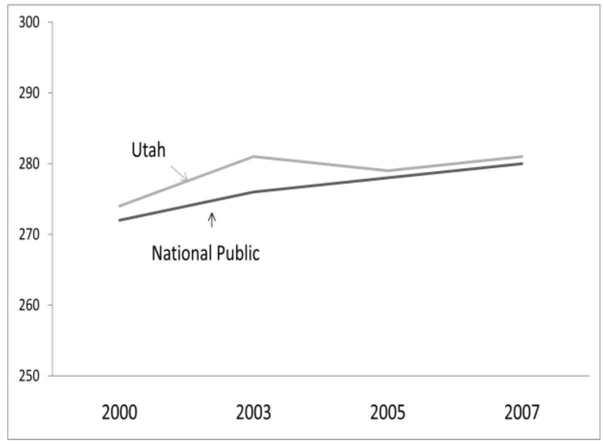
National Assessment of Educational Progress (NAEP)

Utah students perform at or slightly above the national average on the National Assessment of Educational Progress (NAEP); however, scores in both fourth and eighth grades have not been improving at a statistically significant rate over time.

NAEP: Grade 4 Trends



NAEP: Grade 8 Trends



Advanced Placement and ACT Scores

Utah students score well on Advanced Placement mathematics tests. Enrollment has increased steadily for all three mathematics tests, nearly tripling in Calculus AB and BC since 2004 and increasing almost nine fold in AP Statistics during the same time period. At the same time, average scores have either held steady or increased, with Utah students scoring above the national average in Calculus AB and Statistics.

In 2009, the average mathematics score for Utah students taking the ACT was 21.1, slightly higher than the national average of 21.0. ACT uses a benchmark score of 22 to predict which students will be ready for college-level mathematics classes and mathematics-related majors. The ACT Profile Report for Utah indicates that those who took less than three years of mathematics scored an average of 16.6. Those students who took three or more years of mathematics scored an average of 21.4. In total, 44 percent (10,220) of students received a score of 22 or greater.

The ACT data shows significant achievement gaps. The average ACT score in mathematics for Hispanic students is 18.6, and for American Indian students 17.7, both below the national average. Few of these students scored at a level high enough to be considered ready for a mathematics-related major.

Test Data Summary

It is clear that although there are many positive aspects of mathematics education in Utah, there is also room for improvement. The data reveal a pattern of performance gaps between student populations that are not acceptable. To sustain and improve mathematics education in the state for all children, this gap must be addressed.

Course-Taking Patterns

Utah's students enroll in Algebra 1 by eighth grade at a higher rate than the national average; however, course enrollment patterns indicate that fewer than 30 percent of the students who are considered calculus-bound by eighth grade actually enroll in calculus during high school. Furthermore, less than half of all Utah seniors enroll in any mathematics class.

Teacher Quality and Preparation

High quality instruction is vital to student achievement. The effects of quality teaching account for 12 percent to 14 percent of the total variability in student mathematics achievement on a yearly basis, and the effect of effective or ineffective teaching compounds dramatically over multiple years (NMAP, 2008). A teacher who is highly capable is well prepared in content and uses effective instructional practices.

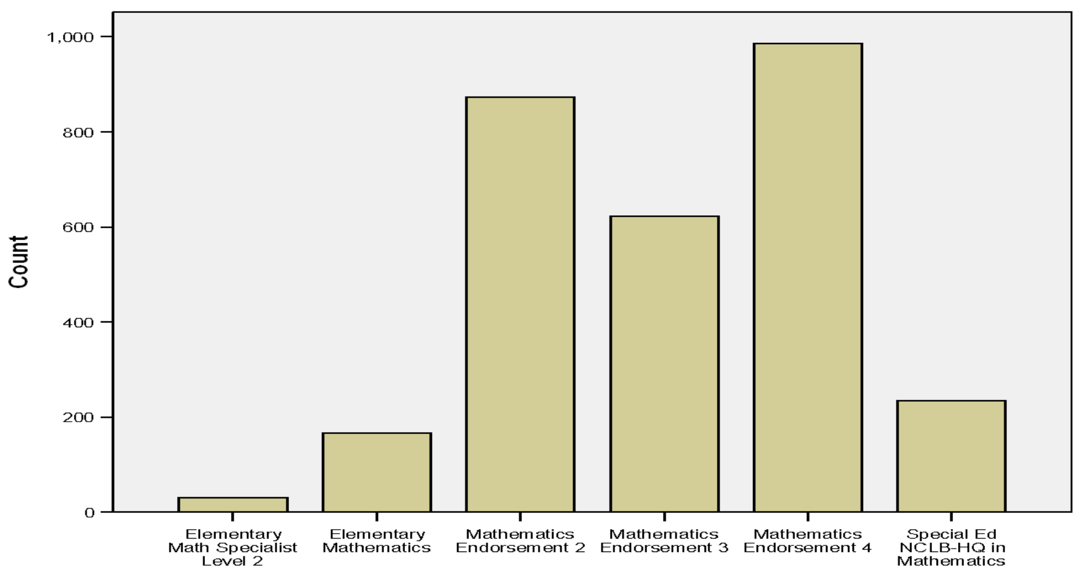
In 2008-2009 there were 1,913 teachers teaching secondary (middle school and high school) mathematics courses in Utah. Eighty percent of these teachers had mathematics endorsements. Of those without a mathematics endorsement, 44 teachers are currently teaching mathematics as part of an alternate route to licensure and 39 are working on State Approved Endorsement Plans that will lead to an endorsement in two years. Fifty-five percent of teachers with mathematics endorsements reported a major or minor equivalent in mathematics. The remainder had elementary or Level 2 endorsements, and were most likely teaching in middle schools. In 2009, there were 3,222 out of a total 15,721 secondary mathematics classes in Utah without a highly qualified mathematics teacher.

Teachers must have pedagogical expertise and knowledge of the content they are teaching in order to be effective, including those teaching mathematics in elementary schools. "Teachers must know in detail the mathematical content they are responsible for teaching and its connections to other important mathematics, both prior to and beyond the level they are assigned to teach" (NMAP, 2008). Increased numbers of teachers now hold Level 4 mathematics endorsements, but there is still a need for more highly qualified teachers in mathematics.

The need for knowledgeable mathematics teachers is particularly critical in elementary school. As number concepts build from year to year and become increasingly complex, teachers must have the expertise to develop understanding and skills in their students. Lower-grade teachers need deep content knowledge to develop foundational skills, and upper-grade teachers need even deeper content knowledge to build on those skills while preparing students for the rigorous and abstract work of learning algebra.

The Utah State Office of Education, in cooperation with local districts and charter schools and with funding from the Utah State Legislature and the federal government has made improving teacher quality a priority for many years. Currently 22 percent of the mathematics-endorsed teachers are elementary teachers, including 57 elementary teachers with Level 3 and 4 mathematics endorsements. In addition, in January 2009 the USOE reported 205 elementary teachers with Elementary Mathematics Endorsements, a number that has since increased. In 2009, the USOE began a thorough overhaul of the elementary mathematics endorsement, integrating increased attention to depth of teacher mathematics content knowledge. State-sponsored, federally funded programs support endorsement coursework for both elementary and secondary teachers, and the Public Job Enhancement Program provides tuition reimbursements for teachers pursuing endorsements in mathematics. Last year over 100 teachers completed coursework toward higher-level secondary mathematics endorsements through the Utah Mathematics Endorsement Project, and more completed endorsements through local university programs.

Number of Educators Holding Specific Mathematics Endorsements



Utah colleges and universities are also reevaluating their teacher preparation programs. In 2001 the Conference Board of the Mathematical Sciences recommended a minimum of nine semester hours in mathematics, and in 2005 the National Council of Teachers of Mathematics recommended a minimum of three mathematics courses for all prospective elementary teachers. Not all Utah institutions meet these requirements, although most are moving in that direction. As the Utah System of Higher Education (USHE) works to coordinate and articulate course offerings between colleges and universities, the goals and desired outcomes for teacher preparation programs will align more closely.

Ongoing teacher professional development is a critical part of mathematics instruction. The Utah State 4-6 Math Initiative of 2006 (HB 181) was a legislative program providing funds to explore the relationship between professional development, teacher merit pay, and student achievement. Districts submitted competitive plans, and all but one of the districts that were awarded funds conducted programs rich in content professional development. These 4-6 Math Projects resulted in significant gains in student achievement by the second year, pointing to the efficacy of focused professional development delivered over time and implemented with fidelity. Because districts were allowed to design their own programs, the professional development was unique to each district and designed to meet the needs of the local mathematics community. Although this program has ended, the research that accompanied the project is being used to improve mathematics programs statewide.

Many Utah districts support professional development efforts with district funds. These efforts target both content knowledge, particularly at the elementary level, and pedagogical skill, particularly at the secondary level. Teachers and education leaders use data to identify needed improvements, target specific content areas, close achievement gaps, and improve the general quality of mathematics education. Data can be used to identify highly effective teachers, including those teaching in disadvantaged situations, and inform others of successful instructional methods and interventions.

Instruction, Curriculum, and Assessment

Instruction, curriculum, and assessment form the triumvirate of a student's experience in mathematics while enrolled in school. Teachers use these three together to define learning objectives, deliver mathematics content, and determine the effectiveness of that delivery in increasing student learning. Like a three-legged stool, no program is balanced without attention to all three.

In 2007, the Utah State Board of Education directed that the State Mathematics Core Standards be revised. Utah State University was charged with the task of leading the effort with assistance from the USOE staff. The university gathered a committee of representatives from several other Utah universities, school districts, and the Utah State Office of Education. The committee rewrote the core based on research and materials, resulting in a rigorous curriculum with improved learning trajectories. The committee used documents from major mathematics organizations such as the National Council of Teachers of Mathematics, the American Statistical Association, and the College Board, as well as curriculum frameworks from other high-performing states.

The 2007 Mathematics Core limits the number of major ideas at every level, and encourages teachers to "go deep" with major mathematics concepts. Each mathematical idea is targeted at one grade level, so students have the time and teachers have the focus to completely develop both the understanding and the skill necessary for mathematics advancement. The new core contains clear trajectories for learning mathematics along a traditional algebra-to-calculus framework. This organization makes the learning of the content critical at each grade level. Students must have access to quality curriculum, instruction, and assessment in every year to adequately prepare them for future mathematical opportunities.

The Utah State Office of Education continues to improve and develop a mathematics curriculum that will deepen conceptual knowledge and develop aptitudes for application of mathematics. Courses such as Mathematics of Personal Finance, Qualitative Analysis, and Medical Math are either currently offered or are being developed to personally connect students to mathematics through application. Increased graduation requirements (from two credits to three credits) propel students toward taking additional mathematics that may not be part of the traditional course sequence.

The Utah State Board of Education and the Utah System of Higher Education, through the work of the K-16 Alliance, continues to seek curriculum alignment among universities and between secondary and higher education. Work is currently underway to examine the linkages between university Math 1010 courses and Algebra 2, and university Math 1050 courses and Precalculus. As a first step in that work, individual universities are examining their own expectations for coursework and creating a more unified expectation of coursework and readiness in lower division mathematics courses. As universities and secondary education examine these courses, they also examine intended outcomes. While university lower division courses often have the purpose of preparing students for upper division coursework, secondary teachers have a broader perspective, knowing that they must prepare students for upcoming classes, and also realizing that for many students high school courses are their last experience with formal mathematics.

Utah's Board of Education has expressed interest in the Common Core Standards that are being developed under the leadership of the National Governors' Association (NGA) and the Council of Chief State School Officers (CCSSO). Because so many national documents were used in the creation of the new core, and because Utah's mathematics education community has been involved nationally for many years, it is expected that Utah's current core will correlate with the common core standards. It is hoped that these standards will bring consensus to the question of what students should learn and when, allowing education professionals to turn their attention to instruction.

The Utah State Board of Education's mission includes a promise to ensure numeracy for all Utah children. The Curriculum and Instruction section at the USOE is committed to achieving this goal, and is currently working on an instructional framework designed to communicate best practices statewide. The recently released 3-Tier Model of Mathematics Instruction is a tool to help administrators and teachers provide leveled instruction and targeted intervention for students with varying abilities. The 3-Tier document and the instructional framework will work together to support teachers as they ensure quality instruction for all Utah students.

Assessments inform teachers and parents of student progress and instructional effectiveness. They provide data on student acquisition of important mathematics concepts, and benchmark student progress in Utah with student progress elsewhere. Quality assessments have the potential to improve instruction and learning through data analysis and provide motivation for students to learn concepts deeply.

Assessment begins in the classroom, when teachers continuously monitor student understanding and adjust instruction to help students achieve. Formative assessment takes place when teachers ask students questions, use progress monitoring tools, and ask students for academic feedback in a variety of ways. Formative assessment informs teachers and students of individual student progress as they prepare them for additional mathematics learning and assessments with higher stakes.

Utah’s assessment system consists of state and national tests that provide information on student learning and program effectiveness. The Criterion-Referenced Tests (CRTs) are linked directly to the objectives for each course. Trends in current CRT data are difficult to interpret accurately due to recent changes in the Core Curriculum and accompanying changes in the tests. Nevertheless, a broad interpretation of recent testing indicates that too many students are not learning core mathematics concepts. Data meetings in the fall of 2009 focused on identified deficiencies, and mathematics coordinators throughout the state are focusing on strategies to improve student achievement and close learning gaps.

Utah’s assessment system has provided a wealth of data for administrators and teachers to use as they work to improve mathematics instruction and achievement. As more data become available, teachers form a clearer picture of student achievement strengths and weaknesses. Many teachers continue to ask for assessments that focus on reasoning and sense-making rather than algorithmic processes, as they fear instruction is being test-driven rather than concept-driven. They also request better assessments for diagnostic evaluation of student gaps that would allow for early intervention.

Mathematics Education Research, and Professional Opinions

Supporting Students and Student Learning

Today’s world places demands on students and graduates not seen in previous centuries. While not all careers require a college education, nearly all require some post-secondary training. The future economic success of students depends on their ability to solve problems and adapt to the 21st century workplace.

Support for mathematics instruction must begin in elementary grades. Students must recognize the importance of mathematics from an early age. Dispositions toward problem-solving and attitudes of persistence are best developed in young children. The importance of quality mathematics instruction by highly knowledgeable mathematics teachers in elementary school cannot be minimized.

Although not all students will need calculus, all students will need mathematics. Students and parents must be given information prior to middle school regarding class selection and its impact on future college and career choices. As students attend middle school, counseling services must be available to students and their parents as they make life-determining schedule decisions. Administrators, teachers and counselors must systematically encourage students to reach their full potential by participating in appropriate mathematics coursework.

Robert Moses, founder of the Algebra Project, describes mathematics literacy as a civil right. Increasingly, Algebra 2 is becoming the gateway to both workforce training and college entrance. In order to receive a college readiness benchmark score of 22 on the ACT, students must be able to multiply binomials, compute geometric areas, and evaluate quadratic functions. While Utah excels at granting students access to higher level mathematics, with 10 percent of seventh graders and 45 percent of eighth graders enrolled in algebra (2007), there is evidence that students in disadvantaged subgroups do not participate in higher-level mathematics at a rate comparable to their percentage of the population. Too many students in all groups do not complete a four-year program of mathematics. Over half of the graduating class of 2008 was not enrolled in any mathematics class during their senior year.

The National Mathematics Advisor Panel (NMAP) recognizes the cultural need for a change in attitude as fundamental to improving mathematics education. The NMAP final report calls for a recognition among students and parents of the importance of effort in learning mathematics. Too many people believe that the ability to do mathematics is somehow inherent, not recognizing that persistence is the most important element in learning. Students who are successful at mathematics receive support not just for the content of mathematics, but for attitudes of persistence and beliefs about success coming from effort. The report states that "recent research documents that social and intellectual support from peers and teachers is associated with higher mathematics performance for all students, and that such support is especially important for many African-American and Hispanic students" (NMAP, 2008).

The mathematics education community relies on the private sector to provide information and support for mathematics education. Information coming from business analysts and reporters is contradictory. Various journal and newspaper articles describe either a need for additional mathematicians and scientists or a glut in the field. One article relates the necessity for today's workers, including non-college-degreed workers, to have strong mathematics skills; the next article interviews job holders who claim to use little more than arithmetic on the job. Business and industry employers want workers with better skills, but have not precisely defined what those skills are. On one hand, algebra is lauded as a minimum competency; on the other, executives say, "I've never needed to solve a quadratic equation." In general, many adults do not recognize their own competencies as mathematics skills, even when they are using them to solve problems, analyze budgets, or make decisions, and other adults are still unconvinced of the importance of mathematical studies.

Educators are appreciative of the lens that has been focused on Science, Technology, Engineering, and Mathematics (STEM). To support and prepare their students for success in these areas they must have specific information on what is needed in industry. How much technology should students use? Are paper-and-pencil methods required, or should high school teachers fill the gaps with other tools? Is pre-calculus needed merely to learn pre-requisite skills for calculus, or are there specific pre-calculus skills that are valuable in the workplace? Educators want to know what specific skills are used in specific occupations. These conversations have begun; more are needed.

Preparing for the Future

Mathematics education for all students is basic to establishing a numerically literate society. It is also a means to prepare individuals for future education and career opportunities. The mathematics education of any student will not end at graduation, but will continue either in higher education or on-the-job experiences.

Educators have the responsibility to prepare students for post secondary education and career pathways. While it is true that some students will elect to enter the workforce immediately after high school graduation, all students must be prepared for continued education at universities or technical colleges. In today's high tech world, mathematics preparation for the workforce is as essential as that for post-secondary education.

Young adults entering the workforce need solid mathematics skills, including the ability to solve problems, communicate effectively, and learn new tasks. Mathematics is needed to solve economic problems, design routing systems, and reason quantitatively about decisions ranging from budget issues to personnel management. Educators are eager to supply the quality workforce requested by business and industry, but the needs are not yet well defined. There is a widely held belief that high schools are not preparing students for direct entry to the workforce, but there is little clarity on what specific skills are lacking. Defining the mathematics skills needed in business and industry is an important next step for those who sincerely hope to improve mathematics education in ways that will prepare students for the workplace.

Recommendations

Utah is poised for significant improvements in mathematics. Working together, Utah's educators, business executives and government officials can take positive steps to ensure Utah's mathematical preeminence. The Mathematics Steering Committee recognizes the strong role that must be played by the entire community if mathematics education is to achieve the goal of mathematics proficiency for all. Community leaders, parents, business owners, and educators must all work together to create an environment that will help students achieve mathematical proficiency and become contributing members of our society.

Utah must be ready to implement change. Utah must be "math ready."

To make the goal of mathematics proficiency for all a reality, the Mathematics Steering Committee proposes the following recommendations.

Teacher Quality and Preparation

- Provide ongoing, collaborative professional development, balancing both content knowledge and pedagogical expertise, that is focused on student achievement and closing the achievement gaps.
- Encourage the creation of professional development partnerships involving peers, business partners, and institutions.
- Explore and implement mechanisms for replicating the success of teachers using best practices in highly impacted and low-achieving classrooms.
- Attend to retention activities such as varied pay and benefit programs that provide flexibility and support services for teachers.
- Provide positive recognition for mathematics teachers.
- Encourage universities to increase emphasis on mathematics content and rigor in elementary teacher preparation programs.
- Encourage universities to increase emphasis on mathematics pedagogy in secondary teacher preparation programs.
- Seek statewide agreement among Utah's institutions of higher learning in teacher preparation programs.
- Require a rigorous elementary licensure exam on mathematics pedagogy and content and study current K-8 licensure requirements.
- Encourage top-performing students to enter the field of mathematics teaching, including elementary teaching.
- Provide financial incentives for recruitment and retention of mathematics teachers.

Instruction, Curriculum and Assessment

- Periodically review the curriculum to ensure that it builds a foundation from which

students can pursue college, technical, and career pathways.
- Require the study of mathematics in the senior year of high school.
- Align the enacted curriculum and assessment with the adopted Utah State Mathematics Core Curriculum.
- Ensure that curriculum and instruction reflect both content and process standards.
- Define and align content expectations between secondary and higher education, including universities and technical colleges.
- Provide learning modules that allow students to fill gaps in knowledge and prepare for further education.
- Commit to building understanding of both secondary education and higher education needs.
- Promote the use of technology as a tool to enhance and deepen mathematical learning and to increase students' access to mathematics.
- Disseminate local and national research results to ensure high-quality, research-based instruction in every classroom.
- Encourage and facilitate the use of leadership tools such as instructional audits in all schools.
- Define quality workforce skills for the 21^{st} century and deliver instruction that will develop those skills.
- Focus assessments on reasoning, sense-making, and problem solving.
- Increase the frequency of formative assessment in classrooms.
- Create assessments that will identify gaps and allow for early intervention to focus on closing the achievement gap.
- Make tests available to teachers to enhance instruction, help students prepare, and provide transparency in expectations.

Supporting Students and Student Learning

- Ensure equitable access to higher level-mathematics for all students.
- Focus on depth of understanding and correct placement of students.
- Encourage representatives from post-secondary institutions, business, and industry to be available as resources to teachers, counselors and students.
- Develop business mentoring programs focused on mathematics applications in elementary and secondary schools.
- Focus instruction to create learners who are flexible and self-directed, think creatively, and can problem solve.
- Explore credit options that would include flexible instructional hours for students and teachers, including opportunities for an extended school day or year.

Preparing for the Future

- Promote a statewide effort addressing the importance, relevance, and necessity of mathematics in education and for career and post-high school readiness.
- Build trusting relationships among business, career and technical education, industry,

various foundations, mathematics educators, and government entities to collaborate, provide resources, and share knowledge.

- Increase counseling support for parents and students to better acquire critical mathematics skills necessary for choice in post-secondary pathway selection.
- Provide for statewide administrative professional development to increase the leadership capabilities and knowledge of administrators and other leaders working towards improvement of mathematics education.
- Integrate mathematics in other content areas.
- Promote a statewide effort to raise public awareness of the necessity of mathematics in various careers.
- Promote the recognition of mathematics as more than a set of algorithmic or calculation skills.
- Align significant public and private resources to improve mathematics education.
- Create a culture and provide supports so that all students will graduate from high school college- or career-ready.
- Define business and industry needs for a quality workforce, and develop instruction to support acquisition of skills to meet those needs.
- Align expectations and mathematics content to skills that will be required in technical training and employment.

Priority Recommendations

- Build trusting relationships among business, career and technical education, industry, various foundations, mathematics educators, and government entities to collaborate, provide resources, and share knowledge.
- Define and align content expectations between secondary and higher education, including universities and technical colleges.
- Encourage universities to increase emphasis on mathematics content and rigor in elementary teacher preparation programs and mathematics pedagogy in secondary teacher preparation programs.
- Focus on depth of understanding and correct placement of students.
- Require a rigorous elementary licensure exam on mathematics pedagogy and content and study current K-8 licensure requirements.
- Promote a statewide effort addressing the importance, relevance, and necessity of mathematics in education and for career and post-high school readiness.
- Provide ongoing, collaborative professional development, balancing both content knowledge and pedagogical expertise, that is focused on student achievement and closing the achievement gaps.
- Require the study of mathematics in the senior year of high school.
- Seek statewide agreement among Utah's institutions of higher learning in teacher preparation programs.
- Develop business mentoring programs focused on mathematics applications in elementary and secondary schools.

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