

## I. Welcome and Introduction.

Brenda Hales, Associate Superintendent of Utah State Office of Education, welcomed math educators, state leaders, district leaders, higher education leaders, elementary educators, legislative leaders, and business leaders for their willingness to come together and talk about mathematics instruction in the state of Utah. Brenda explained that the support from the legislature for improving math education is incredible.

Brenda related a story of traveling to a meeting to be held at Daniel's Summit, before the days of gps. Because she feels directionally challenged, she was sure to ask directions. The instructions given were go to Heber City and then turn left; there will be a sign for Daniel's Summit. Sure enough when she arrived in Heber City, there was a sign for Daniel's Summit – 17 miles. And so Brenda travel the first paved, then dirt road until she was at the top of a mountain with only wildlife around her. She called her secretary on a cell phone, who explained that there is a conference center called Daniel's Summit and a place at the top of a mountain called "Daniel's Summit." She then received directions on getting to the Daniel's Summit Conference Center. Brenda explained that there is urgency about math education in the state, however, she also knows that it is fruitless to hurry without knowing where we're going and why. There is a tragic gap between mathematics education and skills needed in today's workforce. Our purpose in coming together is to find out where we need to be for workforce and world readiness and how we can get there. She encouraged everyone to set short and long term goals and envision what we would like to have happen for mathematics education in the next decade. Part of our work will be to determine how we will get students to know math, when we will get them to know it, and what kind of math education will be taught. Then how are we doing to train our educators, when will we train them, and what will the professional development look like. We hope to meet once a month; there may be some small groups that meet as well. What should our future agenda look like?

## II. Examining Mathematics Education in the Nation and in Utah

### a. Current state of education in the United States

Lynne Greenwood stated we need to accomplish the mission of having our children world ready with the math that we teach. Referencing the National Center on Education and the Economy summary "Tough Choices or Tough Times," Lynne asked for comments and input. Comments included: It is very forward thinking, but the thought that 16 year olds are ready for college was off the mark. It's not all about numbers, but critical thinking. The idea of pushing control and decision making down to the lower levels (those responsible for teaching students) is a good idea, we've gone the opposite direction at times. Agreed that it is important to recruit the best students to become teachers. Thinking outside the box brings up some dramatically different ideas.

What is the position of education today? Mainly females are going into education because males can't support their family. The teaching profession is often considered a second class profession. America has an attitude problem towards teachers. We are almost stepping back in time in education instead of moving forward. Young teachers are quite

discouraged and have a difficult time staying in the profession. While in some ways the models are changing, we are still operating on the agrarian calendar. It's a tough thing to change what education looks like, but what kind of model will best serve our students?

Lynne led a discussion about different models and what can be changed. Some comments included: The minute you start to work outside the box, you get a lot of pushback from the public. When expectations of a school changes, teachers are often the ones pushing back. People like ideas, until it affects their children. Some teachers ask why we can't we go back to when teaching was fun, fun with the kids, however the world is different, the economy is different.

Students must have today's skills in order to make it in today's world. Many companies are laying off employees and some jobs are becoming obsolete. Some jobs have gone to 3<sup>rd</sup> world countries; if we don't have the skills to accomplish the work required, we will fall behind. Our students need to be life ready, work ready, technology ready, and advance degree ready. Not every student desires to be a college graduate; we need to provide the education to our students so they have a lot of job opportunities.

The summary outlined the need for qualifying exams and the student being able to retest so they could change the track they're in to match their desires. Today's work world is creative work including research, development, design, marketing, and management. While many of these positions are currently being held by U.S. workers, we are quickly losing ground on these positions because our education does not teach skills that match how the world work model is evolving. There is a need to overhaul the testing system so that creative skills are measured. An opportunity exists to have Regional Competitiveness Authorities so that areas of the state are specified regions of expertise and schools in those regions can help students attain skills needed for jobs available in that area.

What is the situation now? What should it be? What can we do about it? Should independent contractors operate schools? Can we provide universal early childhood education? Are we giving strong support for students who need it the most? We want to close the achievement gap. What is the gap and why does it exist? There is a hole in our professional development, how can we fix that? Let's work together on recommendations for math education so that our students to move forward into tomorrow's work world.

b. Current state of mathematics in the United States.

Brenda Hales explained that problems still exist in our math education. Our methods include circling and hawking, but we haven't crossed over and solved the problems. Technology makes math education trickier than before. Algebra and geometry are now needed by blue collar workers. Every 6 months new software comes out and the price of computers goes down. Technology has changed the way jobs are done; most employers today require a higher level of technology knowledge. Technical program students like plumber, respiratory therapist, emergency medical technician need to have excellent reading and technology skills to succeed. Jobs that pay enough to support a family, that

don't require a bachelor's degree, require the same amount of knowledge preparation in order to succeed.

Graduate output in science is particularly low. Students today do take more advanced math, but there is little impact on learning outcome. 28% of high school seniors require math remedial help in college. We learned in 1984 that Chinese students were going to school more and, therefore, scoring higher in math and science than U.S. students. However, we haven't done a lot about it. If we improve standards and expectations within the classroom, grades will reflect actual learning. This generation thinks differently. They want results now, in themselves and with education. If they fail once, they don't go back and try again. With education one size does not fit all. We live in a democracy, and it takes time and requires individual choice to make changes in America. There needs to be individuality in our education system. For instance, Morgan County has a 5% poverty rate, 95% of their land is privately owned, they high property tax base. Their challenges are different than Nebo School District who has a 30-50% poverty rate. Educators are working with students so that they have big gains in learning. If there are computers in homes, there is a big difference in learning. Access to technology is important for all students. Today's student's brains are wired differently, and technology is a big part of how they live, work, and play everyday.

There may be some advantages to working with others states regarding math standards and curriculum. It would help us have leverage in purchasing and having input in textbooks, right now we have no leverage in textbook input or purchases because of our size.

Many students, and teachers for that matter, are resigned that they don't do math. People make that statement, and it seems to be an acceptable to say. However, no one would accept a student or teacher who said "I don't do reading." High standards, quality instruction, professional development, and assessment are essential policy components. The National Mathematics Advisory Panel stated that part of the problem with doing research in education is that parents don't like it when you experiment with their children. They want to know what the problem is and how to fix it, but not use their children to test and research with. They propose a K-8 streamlined curriculum that include math knowledgeable teachers, good instruction in student centered learning and teacher directed studies. They propose that state assessments should be improved in quality and that more research needs to be done.

Singapore math is being looked at as one way to improve math instruction; however it is only one way not a panacea. With today's program a student can do pre algebra, algebra, and then if someone is slower, they can take algebra again. Singapore math is slower and more in depth. The expectation is that students memorize some things, then teaches them to problem solve in a more sophisticated way. Current a report on materials and what works with this type of instruction is being done. Teacher preparation, how teachers instruct, and professional development are all an essential part of this program. Singapore math requires 100 hours of professional development per year. In Singapore, teachers are paid the same as an engineer. Recruitment for teaching starts in college and it is a highly competitive field to work in. You must have content knowledge and teaching skills,

without one of those elements, effectiveness is lacking and it starts in college and it is highly competitive. You have to have content and teaching, if you're missing one of those elements, something lacks. Assessments should be improved in quality and should emphasize knowledge and skills that lead to algebra. Teach our students to think outside the box, mathematically, creatively.

What is the response of teachers in mathematics? Should we get together with other states regarding textbooks? Early year Singapore math books are consumable and will need to be purchased every year. Seventy-five percent of the answers to tests are given to students, the philosophy being that it's better for students to know the material.

c. Current state of Mathematics in Utah

Diana Suddreth focused her comments on the state of mathematics instruction in Utah. NCTM (National Council of Teachers of Mathematics) is the go to organization for math teachers. Utah recognizes their influence in math education in the U.S. Across the country math education looks very different. NCTM emphasizes education focus on fewer math topics, and then go deeper in those topics, the outcome is that students will understand math more fully. The Utah state elementary core curriculum is based on the *NCTM Focal Points*. The Focus of secondary math curriculum is reasoning and sense making; this will prepare students for citizenship, the workplace, and further study. The Utah math core curriculum was updated in 2007. Currently the NCTM report on math education is in draft form; math teachers will read and respond to the report. We know that mathematicians don't sit around and do calculus or algorithms. Reasoning and sense making is the main part of math thinking. The state office would like to write a new course that meets these objectives. Curriculum, instruction, and assessment form a coherent whole in order to support reasoning and sense making. Everyone involved must work together to ensure that reasoning and sense making are the central foci of high school math programs. The last thing we want to do is politicize our math program.

What can we learn from the Singapore math program? Some strengths are: focus on computation, mental arithmetic, and problem solving. Mental arithmetic is very prominent, pencil and paper aren't used. The focus is on problem solving. That creates a challenge for multi step assessments. Assessments are open ended and multiple choice. The program has strict entrance requirements for teacher candidates including 12 semester hours of math in pre-service teacher training, 100 hours of professional development yearly. Not all math teachers have a Bachelors degree, but they are highly trained in the program. In Utah now, teachers receive six (6) hours of pre-service mathematics coursework and an average of less than 40 hours of professional development per year for math.

U.S. strengths include emphasis on higher order thinking, reasoning, connections, and communication. There is a greater inclusion of statistics, probability, and real-world application. Singapore does not include this right now. In the Singapore program teachers don't teach the same grade every year, which helps teachers instruct problem solving. In Singapore, reading and mathematics curriculums are the most important; then there are two other subjects for emphasis. The system relies heavily on preparation and professional

development. School goes from 7 am to 12 noon for the first session, then 12 noon to 4 pm for the next group. Teachers instruct either in the morning or the afternoon and have preparation during the time they aren't teaching.

Diana talked about 2008 state wide enrollment in math courses. UBSCT requires algebra and geometry. By senior year, some 1700 seniors are still taking algebra; there is a big drop in senior math enrollment. Students are not taking math every year, however AP students do well. As a state, we are above the national average, but we are not advancing as much as we have before so the rest of nation is catching up with us.

#### d. Current State of Mathematics in Higher Education

Teddy Saffman from the Board of Regents explained that there is some misinformation about remedial math. Of 11,185 students enrolled in fall 2006 and spring 2007, 28% required remediation, 72% were over the age of 20 (adults going to school first time first year). 70% of those first time adult students took one course of remediation, not 3 as has been reported. In 2003, the Utah State Superintendent (Steve Lang) and Board of Regents President (Cecilia Foxly) authored a document on how student can better achieve success from high school to college. High School and college math and composition faculty were polled on what competencies made students successful. The committee came back in 2005/06 and tinkered with competencies and professional development strategies. Independently schools need to be learning communities, faculty members can say I'm teaching a concept, but students aren't getting it, what can I do? This is how we can raise the levels of all practice. We have not taken the next step yet. The K-16 alliance, a group from all walks of education looking at the whole of education has eight (8) sub groups that work in alliance. Across the board all sub groups work on math education. Higher education and K-12 educators typically do not talk; this is a problem in Utah. Department heads from all state colleges and universities meet together and talk about credit transfer, curriculum, and assessment. Mathematicians, math educators, developmental math experts make up a task force that meet three to four times a year. The regent's task force looks at various issues in education. Competencies, assessment, and learning outcomes are addressed. Teddy can e-mail it to you the meeting findings to you (teddy.saffman@utahboardofregents.com). Essential learning outcomes cross area integration, institutions, accrediting, and organization; how do you know what your students are learning, because we test. How are we testing? Math 1050, what is the content of the class? Higher education syllabus should be available for analysis. We can create a matrix to show content of each class so we can determine how it makes sense for students, and helps us to learn how can we help students love math. AARP has a saying "Divided we fail," higher education and public education in the state need to do a better job of working together on education.

#### e. Current State of Mathematics for Career and Technical Futures

Mary Shumway, Direct of Career and Technical Education at the Utah State Office of Education, stated that many people will say they went to school so they are an expert. Part

of her job means she works with a variety of groups: auto, construction, engineering accounting, composites, healthcare, welding, police, and business leaders to name a few. Of 37,000 students who graduate, 1,000 engineers are needed. What are we doing for the masses? No one disagrees about high standards. What is math literacy? The Utah work force services are saying things that are not working in math education. Students are not coming into the workplace with knowledge of measurements, fractions, and estimating. We're doing good things in education in Utah, whether the children are getting all of it – I don't know. We need to be getting our students ready for success engagement, achievement, and transition. 20-25 % of our children will require a bachelor's degree. 60% of our children need post secondary education (associates degree and advanced training). Workforce leaders talk to her about what the workforce needs, they are saying Utah needs to provide more engineers. What kind of knowledge is needed to get the jobs in our workforce? Students need math concepts and math principles. We need to develop pathways for students so they know what kinds of skills are needed to get the job they want. It is good to have employers say what they need and how we can meet those needs so we can switch our curriculum to make it more rigorous. The same courses are needed for bachelor's degrees or CTE, but applications are different. Rigor means challenging, and then learning to applying it is imperative. Is our math going to be relevant to our students?

### III. Current Efforts to Address Issues

#### a. Utah NASA Math – Oak Norton

Engineers and scientists that have taken us to the stars and improved our quality of life in innumerable ways are retiring in droves and there is a critical shortage of qualified individuals to replace them. The legislature, Board of Education, higher education, and citizens have all asked what kind of math initiative can we have so that we will have qualified engineers and scientists in the U.S.

The National Math Panel report says that anyone can do math, it's a learned skill. We need to provide opportunities for schools around the state to adopt world class standards to help our children become deep and critical thinkers, world class thinkers. What is NASA math? The nuclear industry is looking for a wave of new hires, 35% of its work force will retire at the end of 2012. We need a highly technical workforce to ensure safety and productivity in the U.S. There are a few countries that scored above the U.S. on the last TIMSS (Third International Math and Science Study) exam: Singapore, Russia, Poland, Hungary, Japan, and Estonia. The U.S. has elected not to participate in the next TIMSS exam. The U.S. needs more people in the advanced category in order to have our people stay in technological leadership. Our mission is for NASA to hire at least 10% of Utahans as new recruits.

Proposal:

1. Curriculum - adopt Singapore Math Program K-8
2. Rewrite math standards to match Singapore math program
3. Testing - end of level tests would be more TIMMS like
4. Algebra – authentic algebra available by 8<sup>th</sup> grade
5. Student progress – mathematically gifted students can proceed faster
6. Instruction time and schedule – should meet daily average of 4-5 hours of instruction time per week over the 36 week school year. Secondary math credit should require a minimum 144 hours of actual instruction or testing time. Students need daily increments of the subject to build their familiarity and immersion in math.
7. Mathematically knowledgeable classroom teachers - teacher preparation, teacher leaders, teacher evaluation, and professional development.

We are not just teaching math, we are teaching thinking through the medium of math. Visual learning enables students to solve problems. (Mr. Norton gave some examples of Singapore math visual learning techniques). Good problem solving skills and critical thinking are the outcomes of Singapore math. Achieving results by training teachers to teach Singapore math. Why Singapore? Because Singapore has excelled on the TIMMS exam years running.

A myth about Singapore math is that they don't test all students, just those going to technical schools. Not true, the TIMSS exam is given to a cross section of the school population.

The LA times has said that LA Singapore math has added value to inner city title one schools. Singapore trainers came to Utah and in a benchmark school 90% of the students say math is their favorite subject. Economies of scale would have more leverage in purchasing text books and workbooks. The disadvantage is that K-6 workbooks are consumable, so must be purchased every year.

The U.S. Department of Education shows that success in algebra is the single greatest predictor of success in college, not just for engineering and science majors, but for everyone.

[www.utahsmathfuture.com](http://www.utahsmathfuture.com)

Brenda Hales fielded some questions. Are books cheaper? Some of the Singapore math books are consumable books, so could be more expensive. The bottom line would be more measurable if pilots are passed and we were able to study this question. A cost analysis will be done with the review. Does legislation include grant for implementation? There is a copy of the math initiative in the handout folder. Brenda Hales asked that everyone look at it and give suggestions on what to change and what to keep. There will be further drafts on bill. Brenda would like to gather data to use for future questions. Elementary school math in Singapore is great, but high school is not as great. Do children need two years of Algebra 1? One class would be pre algebra/algebra 1/geometry. Next course would be geometry. A majority of students would take 8<sup>th</sup> grade math,

go to algebra 1. Algebra 1 is usually the sticking point. Get them through Algebra 1 to Algebra 2 at high level. Algebra 1 could also be called 8<sup>th</sup> grade math, then transition to algebra 1. We can bring in a demonstration of Singapore math that can be more in depth, so we can learn the details and ask more questions.

Diana Suddreth commented that growing the student includes certain components; we need to decide on the outcomes we desire. What do our outcomes look like and what do we want to offer? How do we nurture our students to achieve the outcomes? She shared the USOE mathematics education mission statement, "The mission of mathematics education in Utah is to promote student growth and learning in mathematics in order to prepare students to thrive and contribute in the global economy of the 21st Century." She also shared a graphic organizer where student growth is the objective.

Lynne Greenwood said that this group comprises the passion that is needed to accomplish the task ahead. She explained that we can get documents on what has been accomplished in the U.S. with Singapore math. This group is the math steering committee and it is our job to review entry level skills for performance to move on to technical higher education, review course offerings, and put together Utah's math endorsement program. She said we're all in this together. Expanding Utah's MESA, gifted and talented, concurrent enrollment classes to meet the math demands. Diana is doing a 3 tier math program for students not getting math, based on the same concepts of the 3 tier reading program. She discussed a demonstration of how important it is to know math in order to design a sleeve to hold tennis balls. What applications can be used with math that will be taught? We want to do pilot programs. It is interesting to note that Utah creates more patents from this state than everywhere else. We need to remember what we are doing right and include that as part of our future math education, let's capitalize on that piece.

Brenda Hales commented that when you have 20-25 percent of students that don't pass the UBSCT, there is a systemic problem. If it's less, that's a student problem. What do we need to do maintain the creativity and curiosity of math for children, what do you add? There are all kinds of ways to build this mousetrap. Let's work together to come to some decisions that are very concrete.

How are we going to teach what students need to know? How will we train our teachers? What teacher legislation could support the goals? Why aren't we getting more test information faster? That requires technology. We need legislation to support the technological needs. 45% of our school are using fiber optic line, 55% are using t1 line which doesn't accommodate the technology we need. With a t1 line, only one person can be on the internet at a time. Another component to Singapore math is technology. Software that comes from our state can't be used in our schools because so many of them only have a t1 line. We must be able to have technology. The rigor is in the core but the relevance is in how it's taught. Don't put all of our effort into one program without seriously considering the questions.

Brenda asked that everyone look at the draft legislation and give their input on what to change what to keep?

Brenda explained that we would now break into groups and as a group answer the following questions: What do students need to know and when? What classroom instruction supports the goals? How will we train teachers? What future legislation could support the goals?

### Higher Education

Solid algebra skills

Calculus ready

Student skills match the course objectives for courses they have taken. Need keen assessment. (understanding the material and retention – need review and preparation)

Teacher preparation should include content-specific pedagogy.

Increased prep for upper-grades elementary and middle school teachers. (elementary should know through algebra, middle school through calculus)

### Workplace/Technical Skills

Some discussion prior to the presentation: there needs to be further discussion of the level of rigor in math students need to graduate from high school and what classes will provide that rigor. We need to study this (what the coursework looks like in secondary). The School board has been discussing this for 5 years, would love an answer to that. What happens in 12<sup>th</sup> grade? How do we restructure so that everyone is engaged in whatever they are going to do next – higher education, technical education, or work. Foundations – elementary

Industry (end user – ask them what they want taught to students) – celebrate education and teachers

Teacher preparation, we need equal amounts of content and pedagogy (elementary tends to have pedagogy not content, sec has content but don't know how to teach it). Secondary teachers need to be practitioners in their field (writers, mathematicians)

Teacher Professional Development

Education professional learning communities at all levels

Communication – industry talking to elementary education, secondary education, higher education

Refocus on basic education – have added a lot of subjects – do we need all of those?

Part of this is helping our teachers to like math – when teacher loves math – helps students love it too. There is a gap in content knowledge when it comes to math. Can address that in professional learning communities. Teacher needs to learn math vocabulary.

Core for elementary teachers that is written more easily understandable – currently it is written in math vocabulary

Have schools report on what they're doing with 4-6 math pilot programs

## Life Skills

Professional development in how to connect math content to life skills

Time is a factor – time to plan, collaborate, implement.

How do we connect math skills to critical reading and thinking? (be a critical citizen use critical thinking skills to help our students to be great citizens, critical consumers of information)

Technology is a life skill

Lobby to include math in courses that are not math courses so students can see the life application.

We keep adding to things, but we also need to have a place where we can go deep.

Lynne closed by reminding participants that math has a language all of its own – how do we connect that to best practices. Talk to your peers and see if there is anyone you want to include in this discussion.

**Next meeting: November 20 Embassy Suites**