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## **Resolution of the Public Education Interim Committee**

### **Utah State Legislature**

**November 2006**

**Whereas**, knowledge, skills and abilities in math, science and technology are of great importance to the economic vitality and future in Utah and the United States, and

**Whereas**, Utah's math scores on national and international benchmarks show success in some concepts but weakness in others, and

**Whereas**, while Utah's highest achievers in math take more advanced math than peers nationwide, there is yet an achievement gap in math for other Utah children and it is wide and pernicious, and

**Whereas**, the single most important factor in student achievement that is controlled by public education is the quality of the teacher and his/her content knowledge and ability to help each child understand math, and

**Whereas**, there is national debate about the appropriate method by which math should be taught, and

**Whereas**, Utah intends to clearly declare its expectations from out of that debate and ensure that as students graduate from high school, they are able in math and can provide the backbone for a steady stream of engineers, scientists, computer scientists, and mathematicians for the future of Utah in industry, education, and business, including the Utah Science, Technology, and Research (USTAR) initiative, and further,

**Whereas**, students in Utah must be able to compete against both national and international peers, it is therefore

**Resolved**, that the Utah Legislature's Public Education Interim Committee (Committee) endorses the plan for a full review of math standards by the Utah State Board of Education (USBE) to result in world-class math standards, and further,

**Resolved**, that the standards identified are benchmarked against the highest performing states and countries, and further,

**Resolved**, that the process for review should be under the direction of the USBE and include a wide spectrum of math content experts as well as math education experts who utilize current research in their review, i.e., Focal Points (National Council of Teachers of Mathematics), National Math Panel recommendations (expected January/February 2007) and the math standards of the highest performing states and countries, and further,

**Resolved**, that the review include the identification of key standards, including a clear standard for quick recall of basic facts in early elementary grades, and further,

**Resolved**, that the review include key standards for the fluency and understanding of standard algorithms of whole number arithmetic in elementary grades, and further,

**Resolved**, that the review include an agreement of the appropriate use of calculators, and further,

**Resolved**, that the Committee further endorses the USBE expectation of greater math content expertise by teachers in grades 4-6, where math foundations must be firmly rooted, and will work closely with the USBE to ensure financial incentives for such endorsements, and further,

**Resolved**, that the Legislature will work closely with the USBE to provide for interventions for students who struggle and for acceleration options for students who can accelerate their learning and that this process will lean heavily upon excellent math software and computer-aided instruction, and further,

**Resolved**, that the Committee supports the USBE in their work to strengthen accountability as it relates to ensuring the core is taught in every classroom in the state.

## **Mathematics Core Curriculum Review Committee Report**

The mathematics core curriculum review committee was a committee of mathematicians, mathematics educators, and public school math specialists that met 4 times in 2006 to discuss the Utah State Mathematics Core (Core). They discussed the writing process, the philosophy of the Core, the quality of the Core, comparisons to other state standards, and the implications of immediate change. A subcommittee was also formed to carefully examine the mathematical content and philosophy of the Core as it compared to the California mathematics standards. Based on the recommendations of the subcommittee and the many hours of discussion, the committee came to the following conclusion:

The Utah state mathematics core is mathematically appropriate and has a good balance between basic skills and conceptual understanding. Although there are areas where the Utah State Mathematics Core could be improved, making those improvements are a much better choice than abandoning them and adopting the standards from another state.

The remainder of this report describes the composition and creation of the full committee, the workings of the subcommittee, and a list of observations and recommendations.

### Composition and Creation of the Full Committee

During the 2006 legislative session, questions were raised regarding Utah's Mathematics Core Curriculum in comparison to mathematics curricula in other states. Discussion regarding Utah's Mathematics Core was held during the appropriations committee when Senator Evans recommended the topic be moved to the Education Interim Committee.

Since the legislative session, the Utah State Office of Education (USOE) has formed a Math Core Review Committee. The committee is comprised of mathematicians and mathematics educators (identified by the deans/departments heads) from each university in Utah, district mathematics coordinators, district curriculum directors, state board members, and USOE curriculum staff.

The members of the committee were:

Brynja Kohler (USU)  
Jim Cangelosi (USU)  
Jennifer Hooper (WSU)  
Tamas Szabo (WSU)  
Aaron Bertram (U of U)  
Anne Roberts (U of U)  
Marilyn Keir (U of U)  
Gina Post (U of U)  
Richard Wellman (Westminster)  
Liz Herrick (Westminster)

Loel Preston (Westminster)  
Christine Walker (UVSC)  
Christine Merrin (UVSC)  
Damon Bahr (UVSC)  
Michael Dorff (BYU)  
Blake Peterson (BYU)  
Eula Monroe (BYU)  
Myra Tollestrup (BYU)  
Eric Freden (SUU)  
Marty Larkin (SUU)

Lisa Jasumback (Davis School District)  
Larry Stott (Salt Lake School District)  
Barbara Kuehl (Jordan School District)  
Nedra Call (Nebo School District)

Diana Suddreth (Washington School District)  
Mark Cluff (Utah State Board)  
Tim Beagley (Utah State Board)

This committee met on March 24<sup>th</sup>, May 5<sup>th</sup>, June 9<sup>th</sup>, and September 22<sup>nd</sup>. During these meetings we discussed the goals and purposes of the Core, the process by which the Core was created, and the questions that would be used by the external review committee (West Ed).

#### Workings of the Subcommittee

At the June 9 committee meeting, Blake Peterson was asked to chair a subcommittee to look specifically at the content of the Core and report back to the full committee. The following individuals agreed to serve on the subcommittee:

##### Mathematicians

Aaron Bertram (U of U)  
Michael Dorff (BYU)  
Brynja Kohler (USU)  
Christine Merrin (UVSC)

##### Mathematics Ed.

Jim Cangelosi (USU)  
Blake Peterson (BYU)  
Lorel Preston (Westminster)  
Gina Post (U of U)

##### School Districts

Lisa Jasumback (Davis)  
Barbara Kuehl (Jordan)  
Larry Stott (Salt Lake)  
Diana Suddreth (Washington, USOE)

In order to have a balanced voice, there were an equal number of mathematicians, mathematics educators, and public school teachers. There was also an attempt to have representation from institutions of higher education in the state. Nicole Paulson and Jerry Evans attended the meeting as observers to answer questions about the creation and organization of the Core. The subcommittee met on August 25 and September 22. The August 25 meeting occurred prior to the release of the West Ed report. Aaron Bertram and Barbara Kuehl did not attend the September 22 meeting and Christine Merrin did not attend either meeting.

The following guidelines were given to the committee members by Blake Peterson in preparation for the August 25 meeting:

I propose the focus of our discussions be on the two elementary grade bands of 3rd and 4th grade and the secondary courses of Algebra 1 and Algebra 2. This will allow us to look at the articulation from one grade to another and from one course to another. Please read and be familiar with the Utah Mathematics Core Curriculum in light of the following questions:

- Does the Core have appropriate mathematics content as compared to the PSSM/NAEP framework?

- What is the balance among procedural fluency, computational efficiency, conceptual understanding, and applications?
- Is the Core developmentally appropriate?
- Do the mathematics content and processes in the Core articulate well?
- Is the intent and purpose of the Core clearly described?

One of the goals of the first meeting will be to articulate answers to the above questions for the given contexts of grades 3 and 4 as well as Algebra 1 and 2.

I encourage subcommittee members to read the California standards for the designated grades and subjects. We could then address the question: How does the Utah Mathematics Core compare to other states and national standards (PSSM)? If you do not have access to a copy of PSSM, let Jerry know and he will get one for you.

The questions that the subcommittee were asked to consider are the same questions developed by the entire committee for the external review by West Ed. In addition to the above instructions, a follow-up email was sent to the committee members to look at the geometry core to see how the algebra articulated through it from Algebra I to Algebra II.

Based on the conversations at the August 25<sup>th</sup> meeting and the follow-up meeting on September 22<sup>nd</sup>, the subcommittee generated a set of observations and recommendations.

### Observations and Recommendations

#### **Observations**

1. In order to better understand the standards from any state it is important that the entire document be read. The introductory material sheds light on the specific grade bands and reading across several grade bands or content areas clarifies how they all fit together. Thus we encourage anyone who wishes to evaluate the Core or compare it to the mathematics standards of another state to be thorough in their reading of each document.
2. Through our discussions, the committee realized how challenging the standards for Elementary Algebra (Algebra I) are to write. With students in Algebra I ranging from the gifted 7<sup>th</sup> grader to the struggling 10<sup>th</sup> grader, it is very difficult to write one set of standards that meets the needs of all students. The Core, however, appears to have been written for *all* students.
3. There is a difference in philosophy between the California Mathematics Standards and the Core, and it is difficult to make a valid comparison between the two documents. The California standards emphasize computation and procedure with less emphasis on conceptual understanding. The California standards appear to be a long list of skills. When someone with significant mathematical background looks at the California standards, they are likely to see the underlying concepts without them being explicitly stated, giving the California standards a clean appearance. The committee members agreed that the Core provides a more

- balanced approach with an organization of standards and objectives and elaborates the underlying concepts and relationships more explicitly.
4. There has been some criticism of how the Core handles quadratics. As it currently stands, the algebra core puts a great deal of emphasis on mastery of linear equations with some introductory material on quadratics. Algebra II fleshes out quadratics in detail. As the committee discussed the placement of quadratics, they acknowledged the pros and cons of the current structure. However, they saw the wisdom of the current structure by not making the Algebra I core so packed with content that they are unable to master any of the content well.
  5. Mathematicians are not necessarily represented by the philosophy of the California Mathematics Standards and there are mathematicians who do support the Core. It is felt that the Core is mathematically rich and mathematically correct.

The recommendations below were presented to and approved by the full committee.

#### **Recommendations for Now**

1. The statements of the law at the beginning of the Core should be placed in an appendix to make the document more user friendly.
2. The glossary in the Core has many errors and it should be removed as soon as possible. In place of the glossary, we recommend including a list of grade appropriate mathematical vocabulary.
3. Teachers need support in implementing the Core. This support could come in the form of professional development, the creation of a separate document for teachers or both.
4. The committee felt that the Core needs better specificity about the acquisition of basic facts. In light of the recent NCTM Curriculum Focal Points, we recommend the use of the term "quick recall" be added. Specifically, the 2<sup>nd</sup> grade core should include the quick recall of addition and subtraction facts and the 4<sup>th</sup> grade core should include the quick recall of multiplication and division facts.

#### **Recommendations for the Next Revision**

1. While the Core designates objectives to be achieved by a specific grade year, some topics may need to be introduced in a previous year without being assessed in that year. This keeps students from being in the position of learning an entire topic in a single year. An example of this is addition of fractions. This is listed as a topic to be mastered in the 5<sup>th</sup> grade, but is not mentioned in any of the 4<sup>th</sup> grade standards. How do 4<sup>th</sup> grade teachers know if they are to introduce this topic in the 4<sup>th</sup> grade? We recommend that in this case there be some objectives that are tagged as "introduction." By doing so, teachers know that they are to introduce the topic, but that it will not be assessed in that grade level.
2. For the next revision cycle, we recommend that the Core Writing Committee begin by reviewing the West Ed Report to gain insights into the strengths and weaknesses of the current mathematics core. After a draft has been completed, we suggest that an external review be conducted to assess the draft document against the current national standards. This will allow the writing committee to make adjustments to the core before it is in final form.

3. We feel it is important that the teaching of the content be integrated across all standards so students can make connections between mathematical topics or concepts. For example, number sense ideas could be introduced in the context of measurement. This concept needs to be included in the introduction (this could be done now), as well as in the examples for specific indicators.
4. We recommend that the Core Revision Committee members should pay particular attention to the language of the Core and to the corresponding perception of the intended audience, K-12 Utah teachers.
5. West Ed's comment that "there seems to be a greater emphasis on procedural fluency and computational efficiency" (p. 18) was a surprise to us. A reexamination of the Core revealed the use of the verbs estimate, compute, and identify in the indicators, while the verbs in the statement of the standards were more conceptual. We recommend:
  - the language of the indicators relate more closely to the language of the standard (specifically the verbs used in the indicators) and the philosophy of the Core.
  - after revisions have been made, Utah K-12 teachers who are not members of the Core Revision Committee should be invited to read and provide their interpretation of the revised Core.
6. California Mathematics Standards designate certain objectives as more important than others. The Core makes no distinction of importance among the various objectives. Since not all objectives are equally important, the Core should incorporate this idea from the California Mathematics Standards. We recommend that the NCTM "Curriculum Focal Points" document should be used as a guide to determine the specific topics that should be emphasized in the next revision.

To reiterate, the committee found that the Utah State Mathematics Core is mathematically appropriate and has a good balance between basic skills and conceptual understanding. Although there are areas where the Utah State Mathematics Core could be improved, making those improvements are a much better choice than abandoning them and adopting the standards from another state. This conclusion was written by the subcommittee prior to receiving the West Ed report. We note that the findings in the West Ed report are consistent with our conclusions.



---

**From:** Jim Milgram <milgram@math.Stanford.EDU>  
**To:** Howard <howard@utahtaxpayers.org>  
**CC:** ltdmd@comcast.net, Greg Hughes <greghughes@utah.gov>  
**Subject:** Re: Help with Utah's Math Standards  
**Date:** Monday, July 09, 2007 11:35:42 AM

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Dear Senators Stephenson and Dayton, and Representative Hughes,

I am honored that you have asked me to do this, but, as you say, it is a daunting task. So the first thing I did was to check with a key colleague to gauge the amount of help that would be available to me from top mathematicians in the country who are also deeply concerned with mathematics education and school mathematics.

Specifically, I have checked with Prof. H.-H. Wu at Berkeley, and, though his time is severely constrained he is willing to help to the extent that he can. I also have every reason to expect that other top level mathematicians such as Prof. Roger Howe at Yale and Prof. Dick Askey at U. of Wisconsin will be willing to help.

With their aid I will be pleased to provide you with standards that are world class, aligned with the Singapore and Japanese standards, and that reflect the focused curriculum strongly suggested by the new NCTM Focal Points.

We should also be able to provide you with considerable guidance on what sensible requirements for teacher certification in mathematics should be for teachers at the elementary level K - 3 and 4 - 5, at the middle school level and at the high school level.

Your fifth request is probably beyond our abilities however. Once a professor is granted tenure at a university or college, it is a very strong tradition in academia that they are then free to teach in the manner they deem best.

Your sixth and seventh requests can probably best be accommodated by giving you the names of the people who are most able to construct the kinds of tests you need, and this is something we can do. Of course, it is worth noting that there are two parts to test construction: first there is collecting appropriate problems, and second, the test has to be shown to be consistent and fair. Where mathematicians can help most

is in collecting appropriate problems.

Likewise, we can recommend current curricula, but over the long term it seems crucial that you involve local people like Prof. Wright, who are sufficiently knowledgeable about the most important issues in selecting programs that will facilitate student achievement in the mathematics crucial to both their success and Utah's economic health. Again, we can help with such recommendations.

As to the first request, I should be able to get started with preparing such a critique of the existing document very soon, but to do this I will need a copy of the proposed Utah math standards. I can download it from the net if you can give me the URL.

Yours,  
R. James Milgram

On Fri, 6 Jul 2007, Howard wrote:

>  
> Dr. Milgram,  
>  
> Thank you for your time on the phone last week and your generous offer to  
> assist Utah in its hour of need.  
>  
> Utahns want to believe their leaders have the best interests of our children  
> at heart and that everything they do will benefit their families. However,  
> increasingly, parents have recognized the deficiencies in the current  
> education system and charter schools and home schooling have taken off in our  
> state. The problems run deep and are compounded due to the firm entrenchment  
> of false philosophies in university education departments.  
>  
> Our current state school board has been ineffective in making changes  
> important to our state and education system such as the desire of the  
> legislature to see Utah have world class standards (which the Department of  
> Education just attempted to prevent meaningful improvement to). The  
> legislature now feels the need to step in and make corrections to a system  
> that has overgrown its bounds and is not capable of governing itself.  
>  
> It is with this in mind that we are turning to you to help us save the  
> education system of our state and have a high degree of confidence that the

> proposals you make to us will be able to be enacted without change due to the  
> current political climate and make-up of the state at this time. That's not  
> to say there won't be opposition to this plan, but we are confident we will  
> be able to sign on the leadership of the House and Senate and make a very  
> strong push to enact these changes.  
>  
> With this in mind, here are a list of the things we would like you to  
> consider providing us with, knowing that your time is valuable and you may  
> not be able to fulfill all of these requests. The bottom line is we are  
> giving you carte blanche to develop a model educational system that would  
> over a period of time become the envy of every state in the nation and bring  
> Utah to a position of mathematical prominence. The list of requests follows:  
>  
> 1) Brief documentation showing how Utah's new standards have need of  
> significant restructuring that does not make sense to do anything but start  
> over  
>  
> 2) Singapore type math standards for K-12  
>  
> 3) Certification requirements for math teachers including what constitutes  
> math education for teachers  
>  
> 4) Professional development guidelines for math teachers  
>  
> 5) Steps to ensure the education colleges are unable to indoctrinate teachers  
> in constructivism  
>  
> 6) Proper testing for teachers  
>  
> 7) Proper end of level testing for K-12 students in math and guidelines in  
> constructing the tests  
>  
> 8) What should a proper math class look like for K-12 and does the block  
> schedule work with world class mathematics?  
>  
> 9) Recommendations on how to handle curricula for use in classrooms and what  
> type of coursework will best meet the standards  
>  
> 10) Any other changes you feel would be beneficial to world class education  
>  
> Sincerely,  
>  
> Senator Howard Stephenson, Co-Chair, Education Interim Committee and Public  
> Education Appropriations Committee  
>

- > Senator Margaret Dayton, Co-Chair, Education Committee and Chair of Senate
  - > Education Standing Committee
  - >
  - > Representative Greg Hughes, Co-Chair, Education Committee and Chair of House
  - > Education Standing Committee
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**From:** Jim Milgram <milgram@math.Stanford.EDU>  
**To:** Howard <howard@utahtaxpayers.org>  
**CC:** ltdmd@comcast.net, Greg Hughes <greghughes@utah.gov>  
**Subject:** Re: Help with Utah's Math Standards  
**Date:** Tuesday, July 31, 2007 10:55:56 AM

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Dear Senators Stephenson and Dayton, and Representative Hughes,

I have attached my report on the Utah Mathematics Standards. They are weak but barely acceptable in Algebra I, Geometry, Intermediate Algebra, which contains far too many topics to be effectively treated, and pre-calculus. However, they are among the worst proposed state standards that I have ever seen in grades K - 7!

They are so bad that there is literally no way they can simply be corrected. Indeed, based on some of Prof. Wu's comments in his review of the previous version, they made considerable changes in the seventh grade standards. While they managed to address some of Prof. Wu's criticisms, they managed to introduce new and even more serious errors in the process.

I am sorry that this review is later than I expected. I had finished a review last week, focusing on the seventh grade standards. However, when I made a final check, I found that the standards I had been using had been replaced on the net. So I had to redo the review, and in the process, I felt I should also include some discussion of the issues with the sixth grade standards.

Yours,  
R. James Milgram

On Mon, 9 Jul 2007, Jim Milgram wrote:

>

> Dear Senators Stephenson and Dayton, and Representative Hughes,

>

> I am honored that you have asked me to do this, but, as you say, it is

> a daunting task. So the first thing I did was to check with a key colleague

> to gauge the amount of help that would be available to me

> from top mathematicians in the country who are also deeply concerned

> with mathematics education and school mathematics.

>

> Specifically, I have checked with Prof. H.-H. Wu at Berkeley, and, though

> his time is severely constrained he is willing to help to the extent that he

> can. I also have every reason to expect that other top level mathematicians

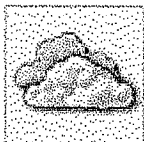
> such as Prof. Roger Howe at Yale and Prof. Dick Askey at U. of Wisconsin will

Monday, August 13, 2007

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## Criticism of math standards irks board

By **Tiffany Erickson**  
Deseret Morning News

Published: Aug. 5, 2007 12:03 a.m. MDT

0 comments

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The State Office of Education has displeased some legislators by unanimously approving new state secondary math standards some lawmakers say just don't cut it.

But State Board of Education members say the standards are a significant improvement from before, and they didn't take kindly to a letter from lawmakers that was sent to board members Thursday urging them to reject the proposed new standards because they are not the "world-class" standards the committee set out to create.

"We believe we had very responsible and educated people on the committee that (drafted the standards) — but as we go along everyone is going to have a differing opinion," said board member Teresa Theurer, who said she was extremely supportive of the new standards.

"Personally I was disappointed that an e-mail like that would come right before board meeting. I think that is really, really poor taste — this has been going on a very long time," she said. The board plans to send a reply next week addressing a few of the "misconceptions" the lawmakers had.

But Howard Stephenson, R-Draper, who sent the letter along with Sen. Margaret Dayton, R-Orem, and Rep. Greg Hughes, R-Draper, said the state board has made only marginal improvements that are unacceptable.

Story continues below

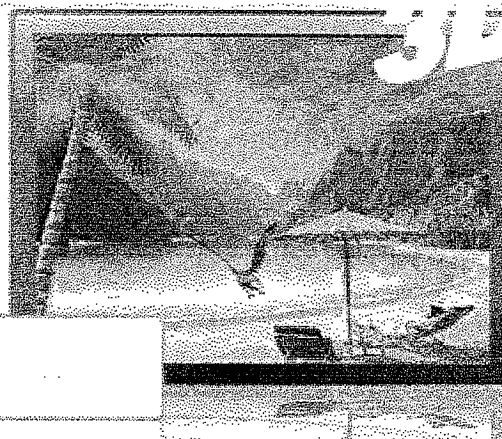
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The legislators had earlier sought input from national mathematics expert and Stanford University professor James Milgram, who said the new standards are "so bad that there is literally no way they can simply be corrected."

"I am not going to sit idly by while the state school board accepts mediocrity. ... These are weak standards and should not have been approved," Stephenson said. He told the Deseret Morning News he now plans to convince the Legislature to set the math standards through legislation next session.

"There is sort of a culture in the State Office of not wanting to move into the 21st century and not wanting to compete in this world — if I were the other citizens of Utah I would be very worried about the actions of our state board. They are not helping, they are not part of the solution, they have proven today that they are part of the problem," Stephenson said.

In February 2006, Stephenson tasked a committee with studying the state's math core to correct problems he saw with the Alpine School District's controversial program, which allowed unconventional problem-solving methods to be used in deepening a student's understanding of math.

The committee, which included some of the nation's top mathematicians and math education professors, gave mixed reviews of Utah public school math, with some experts believing only a few changes were needed and others calling for a complete curriculum overhaul.



In November 2006, the Legislature's Public Education Interim Committee ordered creation of "world-class math standards," and a new committee went to work.

The mathematicians and math education professors on the committee were frequently at odds with each other over goals and developmentally appropriate methods for the Utah core.

During the past few months the state held a number of presentations and public comment sessions statewide.

And though the new standards will be in effect immediately, they could change again if the Legislature steps in, something Stephenson said has been done in other states.

"The Legislature has always had the prerogative of setting these standards. It has the power of purse and the power of setting standards," Stephenson said. "When a state board has been derelict in setting those standards, it's appropriate for the Legislature to intervene."

For more information on the standards visit  
[www.schools.utah.gov/curr/math/sec](http://www.schools.utah.gov/curr/math/sec).

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*E-mail: [terickson@desnews.com](mailto:terickson@desnews.com)*

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From: Howard [mailto:howard@utahtaxpayers.org]  
Sent: Thursday, August 02, 2007 3:48 PM  
To: Dixie.allen@uintah.net; rosanita.cespedes@slcgov.com; Miya, Cyndee;  
Reid, Josh; dbrown@aros.net; Burningham, Kim R.; Cannon, Janet A.;  
Cluff, Mark; Colbert, Bill; Gregory, Thomas; Haws, Greg W.;  
jensen1brit@earthlink.com; Mackey, Randall; Morrill, Denis;  
mossof@msn.com; Roberts, Debra G.; Sadler, Richard; Theurer, Teresa L.;  
rosanita.cespedes@slcgov.com; Miya, Cyndee; Reid, Josh; Affleck, Twila;  
Harrington, Patti; Hales, Brenda; Ogden, Patrick; Park, Judy; Shumway,  
Larry; ltdmd@comcast.net; Greg Hughes  
Subject: Please Reject Proposed Math Standards

Dear Chair Burningham, Superintendent Harrington and members of the  
State School Board:

Feedback from constituents regarding the new state math standards has  
prompted us to seek outside opinions concerning the newly produced  
standards. Based on the information we have received, we are  
recommending that the Board not approve the proposed new standards  
because they are not the "world class standards" the committee was  
charged with creating.

It is our understanding that the committee produced standards prior to  
an external review that did not contain such elementary concepts as  
exponents and logarithms in upper grade classes. Fortunately, this has  
been corrected, but it speaks to the level of rigor and  
comprehensiveness the committee was seeking. It is also our  
understanding that eleven of the sixteen members of the committee had  
just last year signed a document which asserted that Utah didn't need to

revise its standards even though the Fordham Foundation has given Utah a

"D" grade and the U.S. Chamber of Commerce a "C" grade for our  
standards.

It is with these concerns in mind that we have sought direct input  
concerning the proposed standards from Dr. James Milgram who previously  
appeared before the education sub-committee during the interim meeting  
in October 2006.

The legislature now has obtained an independent review from Dr. Milgram  
concerning the newly formed standards. As you can see from Dr. Milgram's

letter (shown below) and his analysis (attached PDF document), the  
proposed standards are greatly lacking. We have also received news from  
Dr. Wu, the external-reviewer engaged by the committee, that as he  
reviewed the final copy of the standards, his suggestions and critiques  
were virtually ignored throughout the entirety of the document. The  
standards are not "world class" as we were assured they would be.

We encourage the members of the state school board reject the standards  
at your August 3<sup>rd</sup> meeting. We feel so strongly about Utah having world

class standards that if the standards are adopted by the Board in their

present form, we will seek to convince the legislature to set the standards statutorily with the advice of Dr. Milgram and Dr. Wu.

In conjunction with Dr. Milgram's professional career in writing standards and evaluating world class education systems, we would seek to

have the legislature also request Dr. Milgram to provide policy direction on the following items:

- 1) Certification requirements for math teachers including what constitutes math education for teachers
- 2) Professional development guidelines for math teachers
- 3) Proper testing for teachers
- 4) Proper end of level testing for K-12 students in math and guidelines in constructing the tests
- 5) What should a proper math class look like for K-12 and does the block schedule work with world class mathematics?
- 6) Recommendations on how to handle curricula for use in classrooms and what type of coursework will best meet the standards
- 7) Any other changes he feels would be beneficial to world class education

It is our hope that we can avoid legislation regarding these standards. Therefore, we highly recommend the state board improve the math standards, so that the legislature can avoid the need to act.

We appreciate this opportunity for our respective elected bodies to work together to achieve the best possible education for the students of our state.

Sincerely,

Senator Howard Stephenson, Co-Chair, Education Interim Committee and Public Education Appropriations Committee

Senator Margaret Dayton, Asst. Chair, Education Interim Committee and Chair of Senate Education Standing Committee

Representative Greg Hughes, Co-Chair, Education Interim Committee and Chair of House Education Standing Committee

Subject: Re: Help with Utah's Math Standards  
Date: Tue, 31 Jul 2007 09:55:54 -0700 (PDT)  
From: Jim Milgram <milgram@math.Stanford.EDU>  
To: Howard <howard@utahtaxpayers.org>  
CC: ltdmd@comcast.net, Greg Hughes <greghughes@utah.gov>  
References: <468E89E7.2080505@utahtaxpayers.org>  
<Pine.LNX.4.62.0707091008120.25410@math.Stanford.EDU>

Dear Senators Stephenson and Dayton, and Representative Hughes,

I have attached my report on the Utah Mathematics Standards. They are weak but barely acceptable in Algebra I, Geometry, Intermediate Algebra, which contains far too many topics to be effectively treated, and pre-calculus. However, they are among the worst proposed state standards that I have ever seen in grades K - 7!

They are so bad that there is literally no way they can simply be corrected. Indeed, based on some of Prof. Wu's comments in his review of the previous version, they made considerable changes in the seventh grade standards. While they managed to address some of Prof. Wu's criticisms, they managed to introduce new and even more serious errors in the process.

I am sorry that this review is later than I expected. I had finished a review last week, focusing on the seventh grade standards. However, when I made a final check, I found that the standards I had been using had been replaced on the net. So I had to redo the review, and in the process, I felt I should also include some discussion of the issues with the sixth grade standards.

Yours,  
R. James Milgram

# An Analysis of the Draft Utah Math Standards

R. JAMES MILGRAM  
Prof. of Mathematics  
Department of Mathematics  
Stanford University

## Introduction and Conclusions.

In reviewing the new Utah Mathematics Standards I felt it best to focus on sixth and seventh grade. The problems there are representative of the problems in the previous grades and in the separate discussions of Algebra I, Geometry, and Intermediate Algebra. Also, compared to the material in the lower grades, the failings in the new Utah Mathematics Standards document become more evident in sixth and seventh grade. For example, by seventh grade it becomes clear that Utah's requirements are roughly two years behind those of high achieving countries, and the mathematical errors - of which there are a very large number throughout all the lower grades - become more obvious.

A number of the errors that were present in seventh grade and above when I first looked at the document have recently been corrected - apparently in response to the criticism that Prof. H.-H. Wu of Berkeley University gave of those standards. However, in the process the editors have introduced new errors and have not addressed the fundamental problem that these standards are far below international expectations.

My overall conclusion is that though there are a number of correct and well stated standards scattered throughout the Utah Standards, the document cannot simply be edited to achieve anything like a world class level. It must be entirely redone. A much greater focus on the key material is required, and the related standards need to be crafted in a way that makes clear both the content and the concepts related to the content that are required.

I also find it incomprehensible that the excellent review that Utah asked for from Prof. Wu was essentially ignored by the editors of the document in grades K - 6. In fact he informed me that

"Except for (I think) three or four small instances involving very simple changes in the standards of K-6, such as the change of one word (e.g., 'value' to 'number'), they left intact almost EVERY objection I made. In other words, the mess is still where it was before."

As a result, I am forced to conclude that the main people involved in the editing of the K-6 standards have a very fragile understanding of the mathematics involved in these grades. Consequently, I will be a little more detailed in my discussion of the mathematical issues involved in some of the more egregious errors in the sixth and seventh grade standards than Prof. Wu was in his report.

**Note:** The standards entitled "Math 7" give a remedial course for students not ready for the regular seventh grade course. The actual seventh grade course is called "Pre-Algebra" in the Utah document. As a result I will not comment on any of the "Math 7" standards below, but will focus on the Sixth Grade Standards and on Pre-Algebra.

### **General Comments on the Utah Grade 6 and Pre-Algebra Standards.**

We begin by looking at the overall structure of the Sixth Grade and Pre-Algebra standards.

First note that there are 5 "Standards," 14 "Objectives," as sub-headings under these standards, and 51 items as sub-headings under the objectives in sixth grade. There are also 5 Standards, 14 Objectives and 49 sub-headings under the objectives in the pre-algebra document. In fact, the sub-headings under the objectives are, effectively, the actual standards and I will focus on them.

Each sub-heading is given in highly compressed form, usually taking, at most, about  $\frac{2}{3}$  of a line. As a result, all too often it is literally impossible to figure out what the sub-headings are trying to do. Among those I can understand, a significant number seem to contain serious mathematical errors. Moreover, there often seems to be little connection between the sub-headings and the objectives they are under.

One also should note that when we look at the standards of the high achieving countries there are far fewer standards in these grades. The high achieving countries have pruned out the non-basic material, such as almost all of the standards in data analysis and probability so that students can focus on the material that is essential for supporting their learning of more advanced material later. (Data analysis and probability are important topics. However, to actually say anything substantive about them requires far more mathematics and far more sophistication in mathematics than is available in sixth/seventh grade, and should be reserved for a serious course at the high school level.)

This focus on key topics is now accepted as crucial for improved outcomes by all three major mathematics associations in this country - NCTM, AMS, *American Mathematics Society*, and MAA, *Math Association of America*. The NCTM acknowledges them with its Focal Points, and the AMS, MAA, have, on the MAA web-site a very important document that begins as follows:

"The value of a mathematical education and the power of mathematics in the modern world arise from the cumulative nature of mathematics knowledge. A small collection of simple facts combined with appropriate theory is used to build layer upon layer upon layer of ever more sophisticated mathematical knowledge. The essence of mathematical learning is the process of understanding each new layer of knowledge and thoroughly mastering that knowledge in order to be able to understand the next layer."

My understanding was that the Utah legislature had asked that the new Utah stan-

dards be modeled after the new NCTM Focal Points. These focal points align fairly closely with what is **DONE** in high achieving countries, though the Focal Points go about things in a more leisurely way, so the material in the seventh or eighth grade in the Focal Points will have been done earlier in high achieving countries. Moreover, at least in grades K - 5 little besides the material covered in the NCTM Focal Points (through grade 7) is studied during mathematics instruction in the high achieving countries.

However, in the proposed new Utah standards the material from the Focal Points only makes up a small part of the standards at each of sixth and seventh grade, so the **FOCUS** that is essential to the leading international standards and curricula is impossible to duplicate in courses aligned with the new version of the Utah Standards. (I'm not saying that the existing Utah standards are any better than the proposed new standards - they are, if anything, even worse - but what I am saying is that if Utah wants to see significant improvements in student outcomes in mathematics and mathematics related topics, then these new standards have to be completely redone.)

### Detailed Comments on the Utah Grade 6 and Pre-Algebra Standards.

The authors of the new Utah standards had the advice of only a very small number of mathematicians. From what I understand, the majority of the committee routinely ignored much of that advice, and this shows. What follows is just one example. The second of the three seventh grade focal points is

"Measurement and Geometry and Algebra: Developing an understanding of and using formulas to determine surface areas and volumes of three-dimensional shapes."

In the discussion included with this focal point in the NCTM document is the very carefully written sentence:

"Students see that the formula for the area of a circle is plausible by decomposing a circle into a number of wedges and rearranging them into a shape that approximates a parallelogram."

However, in the sixth grade standards we find Standard IV, Objective 1(d)

"Decompose a circle into a number of wedges and rearrange the wedges into a shape that approximates a parallelogram to develop the formula for the area of a circle."

In the Focal Points the key word in the sentence is *plausible*. Note that it is entirely absent in the sixth grade standards. Instead students are to *develop the formula for the area of a circle*. Well, flatly, they can't! In order to do this one needs the concept of a limit, and hence the beginnings of the calculus. But people who know very little about mathematics typically make these kinds of mistakes. Such errors are everywhere in the new Utah document.

Here are another series of really bad errors. The sixth grade Standard I, Objective

1(a) reads:

“Recognize a rational number as a ratio of two integers,  $a$  to  $b$  where  $b$  is not equal to zero.”

Prof. Wu strenuously objected to this standard in his report, but his objection was ignored. So let me spell out in more detail what is going on mathematically. Unfortunately, a ratio is not really a number. A ratio really is a line through the origin in the coordinate plane. (We say that two distinct pairs of real numbers,  $(a, b)$  and  $(c, d)$  with  $a^2 + b^2$  and  $c^2 + d^2$  non-zero, represent the same ratio if and only if they both lie on the same line through the origin.) We only obtain an identification of all ratios but one with fractions through the use of slope to distinguish the lines other than the  $y$ -axis through the origin. So the authors of the Utah standards are mixing apples and oranges, and in the process, attempting to guarantee that the typical total confusion among K - 12 educators about ratios, rates and proportions will be propagated to the next generations of students.

In the original Pre-Algebra standards this error was not present, but it was added to the new, corrected, version. Now the Pre-Algebra document contains Standard II Objective 1(c):

“Represent percents as ratios based on 100 and decimals as ratios based on powers of 10.”

Decimals are simply fractions with denominator a power of 10. But we are being told here that decimals are ratios - lines through the origin. Moreover, “ratios based on 100” is meaningless. I think the authors meant to say that a percent is a fraction of the form  $\frac{a}{100}$ , something that is also incorrect, but that one finds in any number of textbooks in this country. In fact,  $a$  can be any real number, and  $a$  percent simply means the ratio represented by the line through the origin with slope  $\frac{a}{100}$ . It’s also worth noting that Standard II 1(a):

“Compare ratios to determine if they are equivalent,”

again is mixing apples and oranges. A ratio is already an equivalence class - of the points on the line through the origin that represents the ratio. The authors are again confusing ratios with fractions and “equivalent fractions” with “equivalent ratios,” but this latter concept simply makes no sense. Likewise, I can’t make any sense of II 1(b):

“Compare ratios using the unit rate.”

Since ratios are really lines through the origin, about all we can determine is if we are dealing with different lines or the same line. There is no way of saying one ratio is *bigger* than another any more than we can say one line is bigger than another.

I am not saying that we should introduce ratios as lines through the origin in the early grades, but we should **never** tell students incorrect things about mathematics. What can



and should be done in the lower grades is to give accurate descriptions of the properties of ratios, and assure students that later, when they have more tools available, ratios will be firmly grounded for them. That was the way logarithms were handled when I was in fifth and sixth grade and we learned to use logarithm tables for multiplying and raising numbers to powers.

It is worth mentioning that there is a proposed Utah sixth grade standard, I.6(b),

“Add, subtract, multiply, and divide fractions and mixed numbers.”

This is a weak standard because it does not specify that these operations should be entirely fluent. In the first of the third grade Focal Points:

“Number and Operations and Algebra: Developing understandings of multiplication and division and strategies for basic multiplication facts and related division facts,”

we have the requirement that

“Students understand the meaning of multiplication and division.”

Fluency with division and multiplication of whole numbers is assumed by the end of grade 5, and fluency of addition and subtraction of fractions and decimals is also assumed by the end of grade 5. By the end of fourth grade the Focal Points are asking for exactly the level of competence with the four operations on fractions that is in sixth grade in the new Utah Standards!

In seventh grade we have I.1(a):

“Compute fluently using all four operations with integers, and explain why the corresponding algorithms work.”

This is getting there. It refers to integers, not rationals, so the new ingredient is the four operations on negative integers.

Of course, to this point there has been little discussion in these standards of negative numbers. In particular, though one finds mention of the “additive inverse” in grade 6, there is no discussion of how one multiplies two negative integers, let alone the highly mysterious rule  $(-1) \times (-1) = 1$ .

In states where careful thought has been given to the sequence of critical steps students have to take to move from whole numbers and positive fractions to integers and rational numbers, there is usually careful attention paid to the problems inherent in teaching the multiplication and division of negative numbers in a mathematically coherent way.

The next seventh grade standard I.1(b) reads:

“Compute fluently using all four operations with rational numbers, including negative fractions and decimals, and explain why the corresponding algorithms work.”

The problem here is that there are no “corresponding algorithms.” There are definitions of addition and subtraction for fractions -

$$\frac{a}{b} \pm \frac{c}{d} = \frac{ad \pm bc}{bd},$$

and a definition of fraction multiplication,

$$\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}.$$

(Both definitions are conspicuously absent in the Utah standards incidentally.) Once one has these **definitions**, then one simply applies them and uses the ordinary algorithms for integer arithmetic to make everything explicit.

The sixth grade Standard I, Objective 2(b) reads

“Compare and order rational numbers, including positive and negative mixed fractions and decimals, using a variety of methods, including the number line and finding common denominators.”

I find it astounding that the KEY method of comparing fractions, cross multiplying and comparing the cross products, is not mentioned here. Putting the fractions over a common denominator actually involves considerably more work than just cross multiplying.

Another problematic sixth grade standard is I.4(b):

“Recognize that ratios derive from pairs of rows in the multiplication table and connect with equivalent fractions.”

This is taken by the authors of new Utah Standards from the discussion in the Focal Points document. But the main authors of the Utah document do not appear to have sufficiently understood what the Focal Points was actually saying here. What was meant there was that if you select any two rows in the multiplication table and compare the entries in the corresponding columns, then the pairs in any two columns are in the same ratio, so in the  $\times 2$  and  $\times 5$  rows,

$$\begin{pmatrix} 2 & 4 & 6 & 8 & 10 & 12 & 14 & 16 & 18 \\ 5 & 10 & 15 & 20 & 25 & 30 & 35 & 40 & 45 \end{pmatrix}$$

we have that  $\frac{2}{5} = \frac{4}{10} = \dots = \frac{18}{45}$ .

in other words, each pair lies on the same line through the origin. Ratios do not “derive” from the rows of the multiplication table, but the rows of the multiplication

table give excellent examples of numbers that are in the same ratio, and, as a result, the quotients taken in the same order for each pair, represent the same fraction.

There are many other areas where these standards are very problematic, far too many for me to be exhaustive even when focusing on just two grades. I will mention just one more. The sixth grade Standard II.1(b) reads:

“Draw a graph and write an equation from a table of values.”

The issue here is that a table of values is, of necessity, finite. So the only graph one can draw consists of a finite number of points on the coordinate plane. As a matter of logic, it is difficult to see how such a finite number of points can give rise to an equation since, equations, as they are understood in constructing tables, refer to things like  $3x + 2y = 4$  that are true for an infinite number of values of the pairs of variables  $(x, y)$ .

### Conclusions.

As I said, I’ve just scratched the surface here. Prof. Wu’s description of the document as “the mess” is entirely apt.

It has been my experience that when standards do not spell out, in detail, what needs to be covered, that material will not be covered. Additionally, when there is no coherence to the standards, there will be no coherence in instruction. Students will simply learn long lists of factoids, and will never develop anything approaching mathematical proficiency.

It has also been my experience that when the understanding of school mathematics in a state’s standards is seriously flawed, as is the case in these standards, then students continue to learn incorrect things and find that it is extremely difficult, if not impossible, to ever achieve the level of competence in the subject and in any of those areas that depend on mathematics that is required of today’s workers and leaders.

So I am forced to conclude, as I stated in the introduction, that it is impossible to simply revise the Utah document. It must be entirely redone.

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**From:** "Oak Norton" <oak@jwscpa.com>  
**To:** <ltdmd@comcast.net>, "Dennis LISONBEE" <dennislisonbee@mac.com>, "David Wright" <wright@math.byu.edu>, "Howard Stephenson" <howard@utahtaxpayers.org>  
**Subject:** Re: Fwd: Friday Board of Education Meeting  
**Date:** Tuesday, August 07, 2007 10:35:08 AM

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Here's my letter to address some of the issues the state board is wrestling with. Please let me know if you think anything should be changed or shortened. I think I've covered all the topics they are dealing with.

Thanks,

Oak

Dear Superintendent Harrington and members of the state school board,

The recent events regarding the math standards and misperceptions has prompted me to write the following letter through which I hope to bring some clarity.

First and foremost, no member of the state school board is qualified to write math standards, and probably not even qualified to comment on them in anything more than a cursory topical way. That's not an insult, it's just a fact that it is a unique field of study the same way electrical engineering differs from mechanical engineering. They are similar, yet standards writing is more precise and demanding. There are very few people qualified to comment on standards writing in Utah because Utah is a small state with very limited expertise in this field. This is one of the reasons the legislature discussed adopting California's A-rated standards last year rather than risk a situation where an unqualified committee in Utah would create something less rigorous than California's standards. Unfortunately, this is the position we find ourselves in at the present time.

From the beginning of this process a number of legislators were deeply concerned that the committee chosen by Brett Moulding and Nicole Paulson was comprised of a majority that signed a document a year ago that our D and C rated (Fordham and US Chamber of Commerce respectively) standards didn't need to be changed. It appears they felt that the status quo of nearly 70% of freshmen needing math remediation was acceptable. People that don't see the problem never see the solution and it was reckless to put this committee together and smacks to me of intentionally trying to torpedo the effort.

I understand some of you are now asking what "world-class standards" are and why they're so important? I am a bit surprised that some are asking this question now when the process to obtain such standards was started last November. To complain that legislators are coming in late in the game is unfair when some board members are now asking for the definition of what was wanted in the first place. The answer to the question though, is in the comments from the legislature wherein they asked that we achieve standards on par with Japan and Singapore. Those are world class standards and they are such because have a limited number of topics at each grade level (far less than us) and then spend the time required to master them. It is the end of the "mile wide and inch deep" syndrome everyone talks about and few see the solution for. This is what leads to proficiency, deep thinking and reasoning skills.

The importance of rigorous and precisely defined standards cannot be overestimated. It sets the foundation for the entire educational system by removing all ambiguity concerning what children should learn and when, and what teachers need to know to impart that knowledge to them. It also creates an environment that will attract high-paying, high-tech jobs because those professionals will know their children will get a world-class education here as nowhere else in the country.

Next, to say to the public "you had a chance to comment on the new standards before we approved them" is a weak

method of passing the buck. You are telling the public that they are the ones responsible for vouching the work done by the committee, when you as state board members were assigned the task of getting us to world-class levels. The failure of the selected committee to do that came to greater attention when all the K-12 standards were on the table and as concerns mounted that the standards were not world-class, several legislators asked for an independent review of the standards from Dr. Milgram who had last October shown the analysis by West Ed concerning our standards to be deeply out-of-touch with reality.

I am unsure how many of you saw Dr. Wu's work on the standards, but many of his comments were ignored by the committee. Nearly impossible to fathom, our \*expert\* committee actually decided against putting logarithms and exponents into the algebra standards until Dr. Wu made it clear that they had to be included. Let me say that again, we would not have EXPONENTS in our standards if we had not had an external reviewer involved in the process, so pitiful were the standards our committee wrote. This illustrates the weak background the selected committee had in understanding the content that needs to be taught to all students to prepare them adequately for college and it leads into the next point.

What level are we teaching to in our K-12 system? Many people think K-12 should be geared toward ensuring \*all\* students get the same education so they encourage subjects to be taught to the level of the lowest 25<sup>th</sup> percentile "so we don't miss anyone". This is just the opposite of what should be. We should be setting the bar high to ensure all students are challenged and that we produce top thinkers, and then remediate those that are truly struggling with the math. There is a fallacy that permeates the education establishment in our country that not all students can succeed at math. I suggest you all take a look at the report from California entitled, "They Have Overcome" which documents high poverty, high illegal alien, high ESL schools which are surpassing other \*rich\* schools because they have administrators and teachers that don't buy-in to the lie that not everyone can learn. Everyone can learn and it's not based on money. They've proven that it can be done without the funding. There are rich and poor schools that fail and others that succeed and it's a function of what students are being taught and what expectations are being set for them. (That said, I am in favor of paying teachers more as their standards for employment are raised as well to match world class teacher standards—for example Hungary requires K-4 teachers to have two full years of college math to become certified to teach.)

Lastly, as for Dr. Milgram's review, I have expressed above that it was late in being asked for and I have first-hand knowledge that it was passed to the board as soon as it was received by the legislators. Dr. Milgram voluntarily performed that review and was in contact with Dr. Wu to ascertain how much of his critique made it into our standards. There was no \*last minute\* bombshell planned, it was just the timing that happened to be. Dr. Milgram has been vilified by several members of the board and state office in an unfair way. He is a renowned mathematician with vast experience in writing standards. He sits on NASA's advisory panel specifically for educational issues and has performed a number of studies to determine how the United States can move ahead and start to catch up with countries like Singapore and Japan. Our new standards are roughly two years behind Singapore by sixth grade according to his review. To dismiss him because we had 16 PhD's on the committee is like saying Einstein's theories should have been dismissed because many others did similar work that arrived at different conclusions.

Dr. Milgram is a man whose comments should be taken very seriously before we set anything in stone for years regarding the new standards. Which of our PhD's that wrote our new standards have similar credentials to Dr. Milgram? The fact that most of the members of the committee that wrote our standards didn't want to change them in the first place and then weren't paid for their work simply categorizes the product of their work as unmotivated, uninspired, and underachieving. The people responsible for putting this committee together should be reprimanded and Dr. Milgram should be asked with Dr. Wu to provide a template for world class standards that can then be set to public review in Utah. We must catch up now or we will continue to fall behind for years to come.

Sincerely,

Oak Norton

**From:** Bill Colbert [mailto:billcolbert@gmail.com]

**Sent:** Wednesday, August 08, 2007 1:24 PM

**To:** Oak Norton

**Cc:** Patti Harrington; Twila Affleck; Kim Burningham; Janet Cannon; Thomas A. Gregory; Greg Haws; Michael G. Jensen; Randal Mackey; Cindy Miya; Denis Morrill; Richard Moss; Josh M. Reid; Debra Roberts; Richard Sadler; Marlon Snow; Teresa L. Theurer; Mark Cluff; DIXIE ALLEN

**Subject:** Re: New standards

Mr Norton,

I don't want to sound trite, but would you please define "world-class" math standards? Also, is there an electronic (or printed) copy of "world-class" secondary and/or K-6 curriculum available for consideration? Further, is any "world-class" math curriculum presently used in any public school system in the United States? If yes, is student performance on national norm-referenced assessment tests significantly better than we observe in Utah? Also, what rigor or specific areas are missing from the new mathematics curriculum the board adopted last week? I appreciate your understanding and goal to improve our curriculum to help make our students more competitive in the world marketplace.

Bill Colbert  
Member, Utah State Board of Education  
District 11

<http://mailcenter3.comcast.net/wmc/v/wm/46C13058000229FA0000687A22165579960B0...> 8/13/2007

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**From:** "Oak Norton" <oak@jwscpa.com>  
**To:** <ltdmd@comcast.net>, "DIXIE ALLEN" <dxiallen@yahoo.com>  
**CC:** <Jennergee@aol.com>, <JHeuer7@aol.com>, <allisonrick@comcast.net>, <caraff@comcast.net>, <judy@djcoxfamily.com>, <lindyjtaylor@gmail.com>, <mglind@gmail.com>, <joemagress@hotmail.com>, <tina\_waters@hotmail.com>, <dennislisonbee@mac.com>, <catherine@tothepoint.net>, <heidylj2@yahoo.com>  
**Subject:** Re: Your emails concerning math curriculum  
**Date:** Sunday, August 05, 2007 10:37:33 PM

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Hi Dixie,

Thank you for replying to my email and the others here. I am grateful for your service on behalf of Utah children in the public education system. I would like to respond to several of your points below. First, what do you know about math standards? I would guess that you know about as much as I do, which is next to nothing. I have been investigating math heavily for the last two and a half years and have built a network of professionals with whom I correspond that ARE experts in math standards. Drs. Milgram and Wu are two of the people I have come to have great respect for. To dismiss Dr. Milgram's review of our standards because the state board didn't want to deal with the facts within it shows a true lack of understanding about what world class standards and that foundation would mean for Utah's future. Frankly, it is a huge disappointment to see the state board act so irresponsibly.

Were you aware that Dr. Wu, the external reviewer, practically had his comments wholesale ignored by the standards writing committee? Did you know that until the external review was done, our \*in-state experts\* had removed logarithms and EXPONENTS in the algebra standards, two critical factors for upper math success and careers in anything beyond the humanities? Did you know that our state standards were rated a D by the Fordham Foundation and a C by the U.S. Chamber of Commerce and that 11 of the 16 appointed committee members signed a document that said Utah had no need to change its standards, effectively preventing meaningful change from happening? All of this is happening under your watch and each school board member will be accountable for this lack of concern and guilt by association.

Are you aware that the 4-6 initiative you mentioned would do absolutely nothing for Utah children? Good education comes from a foundation of knowing what needs taught at each level (math standards), excellent teachers with content knowledge about the subject matter, and good curriculum that adequately covers the topics. The 4-6 initiative was designated to be more about \*how\* to teach, and less on \*what\* to teach, exactly backwards of what should happen in a true world class environment. We need teachers who have the knowledge of math and can impart it, not monkey around with 11 different ways to teach kids what their peers in foreign countries learn 2 years earlier than them.

The unfortunate delay in Dr. Milgram's report is no indictment on himself or any of the legislators. It is further condemnation of the committee who put together sub-world class standards and in large part ignored the external review. Dr. Milgram was contacted to review the standards somewhat recently (as news leaked out about what was really missing) to see what he thought and he contacted Dr. Wu to ask for a copy of his evaluation. It turned out as they corresponded that little of the valuable feedback Wu provided to our committee was implemented, largely due to their shallow understanding of the foundational concepts of how mathematical knowledge is developed, thus invoking Milgram's use of the word "fragile" to describe their limited understanding about standards writing.

So I'm sorry to say, but I am forced to conclude that the state school board really doesn't have the future of Utah in mind when we settle for less than a perfect foundation in math standards. Every single thing that comes of a good educational system is built upon the standards of what needs taught and when, and to settle for less than the best world-class foundation is an indictment this state school board will have to bear.

Sincerely,

Oak Norton

DIXIE ALLEN wrote:

I wanted to reply to your emails to assure you that the State Board takes our Utah State curriculum very seriously. That is why we have a very comprehensive procedure to determine standards for each of the

Core Curriculum areas. The State Office of Education works with educators from elementary, secondary and college levels to determine what standards are necessary for students to be successful at each level of their school placement. They also hold regional public hearings on all of the core curriculum, prior to bringing it to the Board for approval. These public meetings are advertised and open to all – but are not well attended. However, recommendations from these meetings are considered and placed into the curriculum if the committee believes the changes will help the curriculum.

The math core had the advantage of outside evaluators who are experts in the area of math. Also the whole realignment was overseen by professors in mathematics from State Universities, as well as others from outside the state. All recommendations were considered and many incorporated into the standards. I would suggest you access the USOE website and look at the standards and make any specific recommendations you feel would help.

Finally, it is important to note that Utah is not funded to the same level as some of the states, which you hold in comparison. Good curriculum is important, but quality educators are the ones who make the curriculum come alive for students. We have for the past three years petitioned the legislature to fund a 4-6 math initiative to help train all teacher in the middle levels, so they can better understand and teach math. We have also ask for better pay for teachers and a way to reward teachers who choose to teach in areas of most need, ie: math and science particularly. The framework which could address this is called Pro-Excel, but will require funding from the legislature. Good education costs money and this state has not been willing in the past to fund our education system at the same level as other states.

If you have specific questions or concerns, please feel free to email me with your concern and we will attempt to address your issues.

Dixie Allen,  
Utah State Board of Education  
District 14

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Boardwalk for \$500? In 2007? Ha!

(it's updated for today's economy) at Yahoo! Games.

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Dixie,

Thank you for the quick response. I watched the Friday meeting and found it interesting that the Utah Board of Education spent more quality time debating the nutritional value of soda pop sold outside of academic class time than debating curriculum that takes place during academic time. They did not condemn Coke or Pepsi in their meeting, yet they condemned an evaluation by a Stanford professor. Not one of the board members took the time to discuss what is actually in the report, yet they took the time to talk about the vitamins and minerals found in milk. The board discussed the financial loss Pepsi and Coke might suffer and they concluded in the long term all the institutions would maintain their financial gain. On the other hand, the Stanford professor was dismissed by accusing him of writing the evaluation purely for gain.

The board flatly dismissed letters concerning the math curriculum sent by members of the legislature and the public as being inappropriate at this late of a date without considering that there may be merit to the request.

Although it was pointed out in the meeting that Pepsi and Coke may not take a long term loss because the Friday vote, what will be the financial loss to these same students, their families and our state because they got a "B" math program instead of an "A" program? While they may have less cavities upon graduation because of an A+ nutrition program, will they be able to compete Globally with a B math curriculum?

I believe input from the public and from legislators who fund public education is ALWAYS appropriate in our democratic republic, even if it takes place at the LAST hour. (How many last hour pleas have the Utah State Board of Education made to the Legislature or Governor?) The citizens of Utah and members of the legislature petitioned the Utah State Board of Education in good faith to create a WORLD CLASS math program and progress was made. This was done in good faith. However I believe the work is incomplete.

The board pointed out that a school district may impliment higher standards. I believe differently. I believe the math standards should be set to the highest level possible. High enough so our students will be able to compete globally in the future. As a college professor, I know that my students perform at the level expected of them. If we expect B work from a B program, they will only deliver the B. If we give them an A program and expect A work, they will deliver.

I spent a week with Jamie Escalante at Garfield High School in 1989. As you know, he took students in a poor hispanic high school that were failing in math worked with them till they began excelling at AP calculus. A generation that had no hope of higher education and leadership roles in society rose to the occasion. They began dreaming and working and those dreams became a reality. I saw it first hand. What people don't know, is that at Garfield High School this was not just happening in math. The students began excelling in English, History and other subjects. Again, this was not something I was told about. I sat in the classes with these students and observed them. What was the secret? The teachers, students and principal told me it was because Garfield High School had HIGH EXPECTATIONS of their students. They challenged them. They got the parents, ministers and community leaders involved in the lives of the children. It worked.

Our Utah children are more capable than B work. It is time to raise the math bar to an A, not a B. Our students need the opportunity to become competitive leaders instead of lagging followers. In all fields. Math, English, Sciences and the Arts. If we raise math, everything else will follow. That is my vision of the future of education in Utah. We must not settle for anything less.

Thank You,

Dennis Lisonbee  
Associate Professor  
Utah Valley State College

On Aug 5, 2007, at 8:02 PM, DIXIE ALLEN wrote:

I wanted to reply to your emails to assure you that the State Board takes our Utah State curriculum very seriously. That is why we have a very comprehensive procedure to determine standards for each of the Core Curriculum areas. The State Office of Education works with educators from elementary, secondary and college levels to determine what standards are necessary for students to be successful at each level of their school placement. They also hold regional public hearings on all of the core curriculum, prior to bringing it to the Board for approval. These public meetings are advertised and open to all – but are not well attended. However, recommendations from these meetings are considered and placed into the curriculum if the committee believes the changes will help the curriculum.

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Dixie Allen,  
Utah State Board of Education  
District 14

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# UTAH STATE OFFICE OF EDUCATION

Leadership... Service... Accountability

Patti Harrington, Ed.D.

State Superintendent of Public Instruction

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250 East Cesar E. Chavez Blvd. (500 South)

P.O. Box 144200 Salt Lake City, Utah 84114-4200

August 24, 2007

Dear Senators and Representatives:

The Utah State Board of Education takes seriously the concerns raised in the letter you recently received from Senators Howard Stephenson and Margaret Dayton and Representative Greg Hughes. Further, we encourage all legislators with questions about curriculum or matters of school governance to discuss their concerns with board members. We are happy to work with you on these matters.

Since Senators Stephenson and Dayton and Representative Hughes addressed their concerns about Utah's recently approved mathematics curriculum to the full Legislature, we will offer our answer to the full body as well. The Utah State Board of Education and State Superintendent of Public Instruction Patti Harrington believe the new math standards are, in fact, the world class standards that we all want. These standards offer the rigor needed in the classroom and will hold students and teachers accountable for learning. They also offer flexibility to teachers to use their classroom time to the students' best advantage. They are not held to only dealing with practice and drill lessons nor to more conceptual problem solving exercises. Either or both can be used to the students' best advantage.

With that said, we would like to specifically respond to each of the senators' and representative's concerns:

The mathematics standards were not rushed through "without delay." The standards were approved only after months of deliberation and with input from a steering committee headed by Russell Thompson, Mathematics Department Chair at Utah State University, which included mathematicians, mathematics educators, and district mathematics supervisors. Professors from Utah State University, Brigham Young University, Southern Utah University, Westminster College, and the University of Utah participated in the committee. The written standards were then vetted by an external group comprised of Hung-Hsi Wu, a professor of mathematics at the University of California at Berkeley (and sometime collaborator with R. James Milgram, emeritus mathematics professor at Stanford), Janie Schielack, a professor of mathematics at Texas A&M University, and Deanna Winn, a former associate commissioner for academic affairs at the Utah System of Higher Education.

Meetings seeking input from parents and teachers were held throughout the state and all concerns were addressed. We reject the notion that "world class math standards" are determined solely by R. James Milgram or solely by the 2003 math test results of eighth graders in Singapore. From what we can determine from Milgram's letter, he does not object to Utah's standards as much as he objects to how those standards should be taught. Utah's teachers have the professional classroom control to determine the best method to use in teaching their classes.

As to the notion that Singapore's standards are the touchstone that should be used to judge all the world's math standards, we turn to Tharman Shanmugaratnam, Singapore's Minister of Education. In the January 9, 2006 edition of *Newsweek*, he was interviewed by journalist Fareed Zakaria. The article acknowledges that Singapore indeed ranked first in the world in the 2003 TIMMS (Trends in International Mathematics and Science Study). But Zakaria asked why Singapore continues to produce so few top-ranked scientists, entrepreneurs, inventors, business executives or academics. The reply: "We both have meritocracies. Yours is a talent meritocracy, ours is an exam meritocracy. There are some parts of the intellect that we are not able to test well – like creativity, curiosity, a sense of adventure, ambition. Most of all, America has a culture of learning that challenges conventional wisdom, even if it means challenging authority."

Singapore has yet to produce a single Nobel Prize laureate. Denmark and Norway, countries of roughly similar size, have produced 14 and 10 respectively. By the way, the United States scored a 504 in the 2003 TIMMS test, well above the international average of 466. As noted earlier, Singapore led the world with a score of 605. Norway, the country with 10 more Nobel Laureates than Singapore, scored 461.

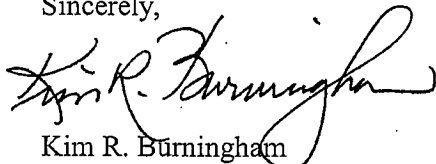
We know Dr. Milgram has been critical of U.S. mathematics teaching methods. We understand this to be part of a larger "math wars" argument raging over the best method to teach mathematics: reform math or basic math.

Please understand that our new curricula standards are neither reform math nor basic math. While the standards do require student understanding of mathematics, they also emphasize mathematics fluency with the basics: adding, subtracting, multiplying and dividing. We encourage legislators to involve themselves in the debate, but not in just one side of the debate.

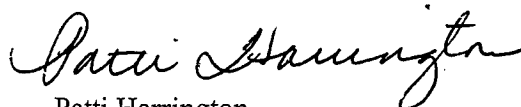
Our new math standards will not leave our students behind. This is a curriculum that will prepare Utah's best to compete with the best in the world in scientific, technological and engineering innovation. It will also equip all Utah students with the math skills needed for tomorrow's world.

We and other board members always welcome discussions of public education issues with you and your fellow legislators. Please feel free to contact any of us at any time.

Sincerely,



Kim R. Burningham  
Chairman, Utah State Board of Education



Patti Harrington  
State Superintendent of Public Instruction

From: Howard [mailto:howard@utahtaxpayers.org]  
Sent: Monday, August 27, 2007 6:32 AM  
To: howard@utahtaxpayers.org  
Cc: fffe@utahsenate.org; smccoy@utahsenate.org; gdavis@utahsenate.org;  
pjones@utahsenate.org; emayne@utahsenate.org; mwaddoups@utahsenate.org;  
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pknudson@utahsenate.org; jgreiner@utahsenate.org;  
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cduckworth@utah.gov; cfrank@utah.gov; cherrod@utah.gov;  
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cwimmer@utah.gov; daagard@utah.gov; dclark@utah.gov; dlitvack@utah.gov;  
ehutchings@utah.gov; fhunsaker@utah.gov; gcurtis@utah.gov;  
gdonnelson@utah.gov; gfroerer@utah.gov; gregghughes@utah.gov;  
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jbiskupski@utah.gov; jdougall@utah.gov; jdraxler@utah.gov;  
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jmathis@utah.gov; jseelig@utah.gov; karenmorgan@utah.gov;  
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wharper@utah.gov; Harrington, Patti; Affleck, Twila; Burningham, Kim R.;  
Cannon, Janet A.; Gregory, Thomas; Haws, Greg W.; Jensen, Michael;  
Mackey, Randall; Miya, Cyndee; Moss, Richard; Reid, Josh; Roberts, Debra  
G.; Sadler, Richard; Snow, Marlon; Theurer, Teresa L.; Cluff, Mark;  
Allen, Dixie; Morrill, Denis; Colbert, Bill  
Subject: Additional Milgram Response to Math Standards

Dear Superintendent Harrington and President Burningham,

Attached is a response from Dr. Milgram to your letter dated August 24th.

Based on his response, we believe there are some shortcomings in your analysis.

We do not agree with your claim that legislators are only looking at "one side of the debate." Which side would that be? We believe that setting expectations that Utah will produce world-class students capable of competing in an international arena an appropriate goal and we invite the state school board and office of education to support that goal.

We hope to achieve greater clarity on this issue in our September Interim meeting.

Senator Howard Stephenson  
Senator Margaret Dayton  
Representative Greg Hughes

## Response to Letter from K. Burningham and P. Harrington

My two recent public reports to the Utah Legislature seem to be the main topic of concern to Burningham and Harrington in their letter, dated August 24, 2007. Unfortunately, they seem to misunderstand what it was I was concerned with and why I chose to compare the new Utah Mathematics Standards with those of Singapore.

In my first letter, what I was chiefly objecting to was the fact that these so called world class mathematics standards that Utah just adopted are filled with MAJOR MATHEMATICAL ERRORS. I went to considerable lengths to list JUST SOME OF THEM IN THE SIXTH AND SEVENTH GRADE STANDARDS. There are many more in these grades and even more in grades 2 - 5.

So one could paraphrase my main objection as pointing out the fact that these standards are functionally MATHEMATICALLY ILLITERATE! As things stand, I would fully expect these new Utah Math Standards to receive an F in the next cycle of ratings by the Fordham Foundation since major mathematical errors are disqualifying.

People then asked me if I could show explicitly why I said that the Utah math standards were at least two years below international expectations by the end of seventh grade. I did this in my second letter by taking the Singapore Standards - they are relatively representative of those of the high achieving countries, somewhat less challenging than those of Russia, Hungary, Poland, but very comparable to those of China and Japan - and comparing the fifth grade Singapore expectations with the seventh grade expectations in Utah.

As to the spurious argument in the Burningham-Harrington letter that Singapore does not have any Nobel Prize winners, I would first suggest that (1) Singapore is both a very small country and (2) a very new country. In fact, it was a British colony from 1867 - 1942, and only fully self-governing since 1955. Realistically, their current education system and its results can't be said to be much more than 40 years old, if that, and people tend to win the Nobel Prize only late in their lives. The modern infrastructure in Singapore is even more recent. It is hard to believe that Burningham and Harrington were not aware of these facts.

More important, the core observation by Burningham and Harrington that

"Singapore has yet to produce a single Nobel Prize laureate. Denmark and Norway, countries of roughly similar size, have produced 14 and 10 respectively. By the way, the United States scored a 504 in the 2003 TIMMS test, well above the international average of 466. As noted earlier, Singapore led the world with a score of 605. Norway, the country with 10 more Nobel Laureates than Singapore, scored 461,"

is beside the point. In fact, it reflects exactly the elitist attitude that is at the heart of the current problem. Nobel Prizes are something only the most brilliant achievers win. These people are, by any standards, the intellectual elite in any country. If - as was the case until very recently in countries like Denmark, Norway, Germany and, unfortunately, even the United States - the objective of the public education system was to give a minimal education to average citizens, but a first rate education to the top five or ten percent, then counting Nobel Prize winners is entirely appropriate.

However, today the problem is that the education we give to the vast mass of our population is not adequate to allow them to compete in the workplace with the mass of people from the high achieving

countries such as Singapore, China, Japan, Poland, Russia and probably India. The TIMSS results that Burningham and Harrington quote above are measures of ALL THE STUDENTS in Singapore, Denmark, and Norway. The fact that Denmark and Norway scored in our range simply reflects the fact that the vast mass of students in Denmark and Norway were educated to the level of our average students, and we know this is not sufficient.

Additionally, it is worth noting that the last time our top students were compared with the top students from other countries was in 1995. At that time our top students scored even worse relative to the top students in the high achieving countries than did our average students relative to their average students.

There will again be an international test of advanced students in 2009. However, when our country was invited to participate, both the U.S. Department of Education and the National Science Foundation, for the first time, refused to allocate funding. The most likely explanation for this extraordinary event is that, at the highest levels in our government, our leaders are afraid of what the comparison will show.

R. James Milgram  
Professor of Mathematics,  
Stanford University

Member: National Board for Education Science, the Presidential Board that oversees the research arm of the U.S. Department of Education,

Member: NASA Advisory Council (the first and so far only mathematician to be accorded this singular honor),

Member: Both the National and International Advisory Boards on TEDS-M, the international study of teacher preparation that will take place in 2009.

Member: Advisory board National Council on Teacher Quality.

Member: Achieve Mathematics Advisory Panel  
as well as other Advisory Boards

Main reviewer and/or outside mathematics advisor for current Massachusetts Mathematics Standards, New York High School Mathematics Standards, Georgia Mathematics Standards, NCTM Focal Points.