Support for **Race to the Top** Applications

As an independently-researched and proven professional development program, **Intel Math** supports U.S. states’ comprehensive plans for effective, systemic professional development, addressing the America’s Recovery and Reinvestment Act (ARRA) reform priority #2 - **Recruiting, developing, retaining, and rewarding effective teachers and principals.**

Intel Math supports the following Race to the Top selection criteria\(^1\):

**State Success Factors:**
*Criteria (A)(1) 30 pts – Building strong statewide capacity to implement, scale up and sustain proposed plans*
Intel Math has been implemented in four states - AZ, CA, MA and NJ, with MA implementing a statewide model; collaborative opportunities exist with those states and others. Intel Math’s National Training Agency, the Institute for Mathematics and Education at the University of Arizona, is well positioned to support states with program implementation.

**Standards and Assessments:**
*Criteria (B)(3) 20 pts - Supporting the transition to enhanced standards and high-quality assessments*
Intel Math’s focus on number and operations, rational numbers, linear equations, and functions address internationally benchmarked common core K-12 math standards. Teacher understanding of this rigorous math supports transitions to enhanced student learning.

**Data Systems and Support Instruction:**
*Criteria (C)(3) 18 pts – Using data to improve instruction*
Due to pre and post assessments, nightly homework, and analyzing student work, Intel Math teachers receive the feedback data they need to inform their understanding and improve their instruction.

**Great Teachers and Leaders:**
*Criteria (D)(5) 20pts – Providing effective support to teachers and principals*
Once teachers get more grounded in the mathematics, they spend time analyzing the same mathematics in student work. Intel Math offers an on-going and aligned Mathematics Learning Community curriculum for teachers to collaborate to improve their overall effectiveness of instruction.

**Turning Around Struggling Schools:**
*Criteria – (E)(2) 40 pts – Turning around the lowest achieving schools*
The most recent NAEP math scores highlight an achievement disparity between Hispanics and African Americans and the other sub-groups. Intel Math offers a solution to this disparity while also helping teachers better understand differentiated instruction in mathematics through course modeling.

\(^{1}\) located on the U.S. DOE website at: [www.ed.gov/programs/racetothetop/index.html](http://www.ed.gov/programs/racetothetop/index.html)
Research Based

Teaching mathematics effectively requires specialized training: deep procedural and conceptual understanding of math, broad understanding of how students make sense of math, and knowledge of how to merge that content and student understanding into effective instruction. While Intel Math focuses primarily on teachers developing a deep understanding of mathematics, it also emphasizes transference to the classroom by the modeling of exemplary instructional practices. Classroom transference is also a focal point through examination of student work—identifying the mathematical big ideas and next steps. Finally, the course has a sustainable component—a mathematics learning community curriculum that mirrors the content of the course through the lens of examining student work. Within this professional learning community, teachers are afforded time to transfer their content and student learning into more effective instruction.

Demonstrating research-quality effectiveness of the Intel Math program requires multiple assessment tools. First, Intel Math was developed directly from Dr. Ken Gross’ Vermont Mathematics Initiative, a three year master’s degree program for teachers. A longitudinal six year study found that students, in schools with concentrated numbers of VMI teachers, achieved at three times the rate of their control group peers. Many of these teachers had up to three years of math content courses but some only had eighty hours of intervention.

Another way to explore effects on student learning is examine teacher certification impacts. A research study by Hawk, Coble and Swanson found that students of teachers who are certified in mathematics, or who have completed more math content courses, perform significantly better than students of teachers who are not certified in math.

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2 Vermont Math Initiative Program Evaluation, Harris and Meyers, May 2005
Intel Math Research and Evaluation

Course Results
The Intel Math program itself utilizes multiple assessment tools to gauge program impact. First, teachers complete a pre and post inventory of mathematical content knowledge. Compiled by WestEd, the results from 2008 yielded significant improvement: "on average, teachers' scores rose 16 percentage points from pre- to post-test." Within that improvement, teachers made the greatest gains on conceptual items vs. computational items.

Intel Math Course Survey Table of Mean Scores on Conceptual & Computational Items

<table>
<thead>
<tr>
<th>Nature</th>
<th>Pre-test Mean</th>
<th>Post-test Mean</th>
<th>Percentage Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conceptual</td>
<td>41.0%</td>
<td>62.5%</td>
<td>21.5%</td>
</tr>
<tr>
<td>Computational</td>
<td>67.5%</td>
<td>81.0%</td>
<td>13.5%</td>
</tr>
</tbody>
</table>

Intel Math teachers also complete a pre and post assessment called the Learning Mathematics for Teaching (LMT) survey for Number Concepts and Operations developed at the University of Michigan. The LMT assessment of teachers' mathematics content knowledge and knowledge for teaching provides a good benchmark for teachers' ability to apply the course content in the context of their work with students.

In 2008, Intel Math teacher graduates showed statistically significant gains on this LMT assessment at the p < 0.005 level. The effect size (mean gain) of .63 standard deviations is medium to large, and according to WestEd, is "commendable given that it is extremely rare to find a large effect size unless the group is very large and/or the participants' initial scores are quite low,"

Course Design
In addition to developing this LMT model, Heather Hill and Deborah Ball, have identified professional development factors which contribute to teacher growth in teaching mathematics. Some of these include a strong focus on math content, co-facilitation by a math educator and a mathematician, significant duration of training (80-120 hrs), and ability for teachers to engage in math problem solving—analyzing solutions and strategies, exploring representations and connections, and proving and communicating thinking. These factors are strongly incorporated in the design and implementation of Intel Math.

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4 Year Two Evaluation of Intel Mathematics—Professional Development Course & Teacher Learning, Cathy Carroll and Susan Mundry, West Ed, June 30, 2009; page 9.
5 Ibid, page 12.
Evaluation Quotes

- “I provided students with a variety of ways to utilize fractions and I really understand the theme of part to whole.”
- “I found it extremely difficult, having been out of college for 30 years. However, it helped me see that I can think and learn in ways that are different from others.”
- “(IM) really made me question what I know, and if I really understand what I have been teaching all these years.”
- “I am now more deliberate in connecting new math concepts to my student’s prior knowledge and in emphasizing the inter-relatedness of different math strands.”
- “I have become more confident in my own learning… I recognize now what relevance the lessons I (teach) have for the kids in their future mathematical thinking.”
- “I wish this program would be required of all teachers.”

"We know that the quality of math and science teachers is the most influential single factor in determining whether a student will succeed or fail in these subjects.”
President Barack Obama  (National Academy of Sciences speech, April 27, 2009, www.nationalacademies.org)