OREGON MATHEMATICS LEADERSHIP INSTITUTE

Partners Oregon State University, Portland State University, Teachers Development Group, RMC Research, and the following ten school districts from across the state of Oregon: Beaverton, Bend-LaPine, Crook County, Molalla River, Redmond, Reynolds, Roseburg, South Lane, and Woodburn

Participants 180 K-12 teachers of mathematics, their 90 building principals, and 10 district administrators

Faculty 36 faculty that include: 20 STEM faculty from 13 Oregon universities and community colleges math departments; 2 school of education faculty; 12 K-12 master teachers; and 2 district administrators

Products

- Six 30-hour graduate level mathematics content courses for K-12 teachers:
  Algebraic Structures, Geometry, Measurement & Change,
  Data & Chance, Numbers & Operations, and Discrete Mathematics
- Three 30-hour graduate level Collegial Leadership in Mathematics courses
- Tools, protocols, and structures to support and sustain powerful school-based professional learning during and between the four annual project site visits to OMLI schools

Purposes

- Strengthen the mathematics content knowledge of OMLI teachers
- Increase the quantity and quality of student mathematical discourse across OMLI schools
- Establish powerful school-based mathematics professional learning communities
- Increase student mathematics achievement and decrease achievement gaps in OMLI schools




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SUCCESS! TEACHERS' MATH CONTENT KNOWLEDGE

- After their third Summer Institute, teachers had completed all six content courses and three Collegial Leadership courses.
- Both elementary and secondary teachers demonstrated statistically significant gains on the overall score and on all subscales for our math assessment.
- More than 2 dozen participants have entered/completed Masters degree programs at OSU and PSU, where OMLI courses apply directly to graduate programs . Several have begun doctoral programs in math education.

Table 1
2007 Secondary SLT Teacher Content Knowledge Results

Scale	Survey	N	M	SD	M Diff	SE	*p*
Arithmetic and Algebra	Pre-	78	.767	.938	.397	.085	**<.001**
	Post-	78	1.164	.774			
Geometry	Pre-	78	.889	.554	.192	.063	**.003**
	Post-	78	1.081	.581			
Overall	Pre-	78	.761	.129	.055	.010	**<.001**
	Post-	78	.816	.107			

Table 2
Elementary SLT Teacher Content Knowledge Results

Scale	Survey	N	M	SD	M Diff	SE	*p*
Number Concepts and Operations	Pre-	84	-.100	.891	.343	.085	**<.001**
	Post-	84	.243	.799			
Geometry	Pre-	84	.228	.780	.479	.068	**<.001**
	Post-	84	.707	.802			
Patterns, Functions, and Algebra	Pre-	84	.101	.801	.372	.083	**<.001**
	Post-	84	.473	.807			
Overall	Pre-	84	.644	.155	.077	.010	**<.001**
	Post-	84	.720	.141			

Note. Statistically significant *p*-values ($p <= 0.05$) appear in boldface type. Raw scores on each subscale for each survey were converted to scale scores (*z*-scores) using lookup tables provided by University of Michigan.

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SUCCESS! MATHEMATICAL DISCOURSE

- Our evaluation research on discourse focuses on a taxonomy of student discourse based on the notion of cognitive demand, with simple responses at the lowest cognitive level and justification and generalization at the highest level
- Early formative evaluation data revealed a need to explicitly address with teachers what constitutes a justification and generalization, especially the differences between students explaining how and justifying why.
- To develop teacher understanding, we adapted the research observation protocol to create an instrument and protocol for productive peer observations (see below).
- Working with the characteristics and cognitive levels of student math talk was integrated into all OMLI "Professional Learning Tasks," or PLTs (e.g., the Student Discourse Observation Protocol above), which OMLI teacher leaders were expected to use regularly in professional development with colleagues in their schools. Our evaluation research indicates that regular use of these OMLI PLTs is positively correlated with students' math achievement.

STUDENT DISCOURSE OBSERVATION TOOL

PF PROCEDURES/FACTS	J JUSTIFICATION	G GENERALIZATION
• Short answer to a direct question • Restating facts/statements made by others • Showing work/methods to others • Explaining what and how • Questioning to clarify • Making observations/connections	• Explaining why by providing mathematical reasoning • Challenging the validity of an idea by providing mathematical reasoning • Giving mathematical defense for an idea that was challenged	Using *mathematical relationships as the basis for:* • Making conjectures/predictions about what might happen in the general case or in different contexts • Explaining and justifying what will happen in the general case

Discourse Type	Discourse-Based Evidence of Student Thinking * Indicates student thinking that I am especially curious about	Co-Inquiry Questions

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SUCCESS! PROFESSIONAL LEARNING COMMUNITIES &STUDENT ACHIEVEMENT

- Analysis of student achievement data in participating schools was initially inconclusive.
- Implementation Rubrics were developed to capture the degree of fidelity of implementation.
- Once implementation fidelity traits were taken into account, a positive relationship between project participation and student achievement emerged.
- The degree to which schools implement the school-based professional learning practices taught during the OMLI project is a significant positive predictor of student performance.
- This predictor is above and beyond what can be explained by socioeconomic factors, as indicated by the percentage of students who qualify for free and reduced lunch.

Oregon Mathematics Leadership Institute

OMLI Implementation Rubrics—2009 Version

Intended Use—This rubric is designed for use by the member of the OMLI Collegial Leadership team to rate the degree to which the schools are implementing the intent of the OMLI project at the school level during the academic school year.

Trait	1	2	3	4
Quality of the Action Plan	**Poor**—Plan is superficial, unrealistic, unlikely to improve mathematics teaching and learning, or no plan was submitted.	**Fair**—Plan has a few strong elements but is not sufficiently comprehensive to significantly impact mathematics teaching and learning schoolwide.	**Good**—Plan is substantial in scope but elements are missing or inadequate. Plan is challenging but possible to implement and likely to positively impact teaching and learning schoolwide.	**Excellent**—Plan is comprehensive yet possible to implement and very likely to positively impact mathematics teaching and learning schoolwide.
Implementation of the Action Plan	**Not Implemented**—The plan was not implemented.	**Minimal**—A small portion of the plan was implemented. Modifications to the plan diminished its positive impact on teaching and learning.	**Partial**—Much of the plan was implemented. Modifications to the plan contributed toward improved teaching and learning.	**Full Implementation and Effectiveness**—The plan was fully implemented. Modifications to the plan improved teaching and learning.
School Administrator Leadership & Engagement	**Poor Leadership**—The school administrator was generally not engaged in efforts to improve mathematics teaching and learning.	**Marginal Leadership**—The school administrator was only marginally engaged in efforts to improve mathematics teaching and learning.	**Inconsistent Leadership**—The school administrator was somewhat engaged and sometimes made positive contributions to improve the teaching and learning of mathematics schoolwide.	**Strong Leadership**—The school administrator was actively engaged in all aspects of the work and consistently made positive contributions to improve the teaching and learning of mathematics schoolwide.
District Leadership	**Poor Leadership**—The district administrators was generally not engaged and/or did not provide leadership for the school's efforts to improve mathematics teaching and learning.	**Marginal Leadership**—The district administrators that were involved did not have the authority to influence mathematics curriculum and instruction and were only marginally engaged in the school's efforts to improve mathematics teaching and learning.	**Inconsistent Leadership**—The district administrators provided leadership for the school's efforts to improve mathematics teaching and learning but sometimes failed to follow through.	**Strong Leadership**—The district administrator had the authority to influence mathematics curriculum and instruction and provided strong leadership that facilitated the school's efforts to improve mathematics teaching and learning.
School Priority of Mathematics	**Low**—Improving mathematics teaching and learning was a very low priority in this school.	**Sporadic**—Mathematics was a priority among some staff members but a coherent, schoolwide effort to improve mathematics teaching and learning was not evident.	**Moderate**—Improving mathematics teaching and learning was somewhat a priority in this school.	**High**—Improving mathematics teaching and learning was the top priority in this school.

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Quality of Professional Development (PD)	**Not Met**—The school has not conducted any PD for the mathematics staff to improve mathematics teaching and learning.	**Partially Met**—The school has partially met its obligation to conduct 2 hours of PD each month.	**Fully Met**—The school has fully met its obligation to conduct 2 hours of PD each month.	**Exceeded Expectations**—The school has exceeded its PD obligation by providing more than 2 hours of PD each month to improve mathematics teaching and learning.
	No Impact on Peers—The school has not provided PD that has influenced the other teachers in the school.	**Minimal Scope**—The school has provided PD only to a few interested mathematics teachers. The PD has not impacted a critical mass of teachers.	**Targeted Impact**—The PD provided has targeted a group of mathematics teachers (i.e., grade level group) and is likely to impact the student performance of a subset of students.	**Schoolwide Impact**—The PD provided has engaged the vast majority of the mathematics teachers in the school and will likely impact student performance schoolwide.
Use of Professional Learning Tasks (PLTs) & Protocols	**Poor**—The PD provided by the school seldom utilized the PLTs or other protocols, and when they were used they were modified or implemented in ways that considerably diminished their effectiveness.	**Fair**—The PD provided by the school utilized some of the PLTs and protocols but they were modified or implemented in ways that diminished their effectiveness.	**Good**—The PD provided by the school utilized many of the PLTs and protocols with some modifications.	**High**—The PD provided by the school consistently utilized the PLTs and protocols with fidelity.
Focus on Discourse	**None**—There is no evidence that the mathematics teachers in this school have made mathematical discourse a priority	**Sporadic**—There are a few teachers who have made mathematical discourse a priority in their instructional practices but most do not.	**Moderate**—There are many (about half) teachers who have made mathematical discourse a priority in their instructional practices.	**High**—There is evidence that the vast majority of the mathematics teachers in the school have made it a high priority to increase the quantity and quality of mathematical discourse among students through justification and generalization.

OREGON MATHEMATICS LEADERSHIP INSTITUTE

APPLYING OUR SUCCESSES: DEVELOPING THE MATHEMATICS STUDIO PROGRAM

Supported in part by OMLI supplemental and Noyce Foundation funding, we are currently developing and researching the Mathematics Studio Program as a replicable and sustainable structure for professional learning that yields mathematical understanding and achievement for all students. This program is grounded by and expands on successful practices and products developed during first phase of the OMLI project.

KEY COMPONENTS OF THE MATH STUDIO PROGRAM

- Courses for teachers and school/district leaders (on-site and/or offered through local higher education partners)
  - Math Content Courses (based on the OMLI courses)
  - Best Practices in Teaching Mathematics seminars
  - Instructional Leadership Seminars for school administrators and math coaches
  - Online courses on mathematics content and pedagogy
- Online Mathematics Collaboratives (to foster, support, and document reflection, collegial dialogue, and progress)
- Mathematics Studios & Leadership Coaching
  - bring Best Practices and Instructional Leadership seminar learning to life in "live" real-time settings
  - increase quality and fidelity of implementation of seminar learning
  - build shared images and understandings about meaningful practice
  - foster productive professional norms and habits-of-practice:

MATH STUDIO & LEADERSHIP COACHING DETAILS

Who participates in a Classroom Studio: a "Studio Teacher," a cohort of about 10 "Resident Teachers, the Studio Principal, and one or more Resident Leaders (e.g., district office administrators, math coaches, etc.). Initially led by an outside consultant/trained local leader; ultimately led by the building teachers/coaches and principal.

When Studios happen: Five 2-day Studio Cycles spread across the academic year

What:
- One half-day of 1-1 Leadership Coaching for the principal as the "lead learner" for the building. Includes planning and "live" rehearsal of leadership practices
- One half-day of inquiry and pre-planning with the Studio Teacher and coach/consultant only
- One full-day, all Studio participants to plan for instruction, enact with students, debrief and infer
- Focuses on the identification and rehearsal of "high leverage" teaching/leadership practices
- Embeds the OMLI PLTs, tools, and frameworks as everyday elements of professional learning
- Always ends with serious commitments by all Studio participants to between-cycle work and support

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