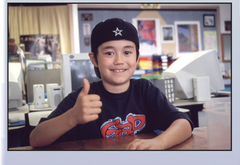
THE MATHEMATICS STUDIO PROGRAM

APPLYING LESSONS LEARNED FROM THE OREGON MATHEMATICS LEADERSHIP INSTITUTE (OMLI) PARTNERSHIP



DEFINING STUDENT SUCCESS

ALL STUDENTS ENGAGE HABITUALLY IN MATHEMATICAL PRACTICES USED BY SUCCESSFUL MATHEMATICIANS

HIGH ACHIEVEMENT BY ALL STUDENTS ON STANDARDIZED STATE MEASURES

EQUITY IN ACHIEVEMENT FOR ALL SUBGROUPS OF STUDENTS

INCREASED PARTICIPATION AND SUCCESS IN ADVANCED HIGH SCHOOL MATH COURSES

THE MATH STUDIO PROGRAM'S LOGIC MODEL FOR ACHIEVING STUDENT SUCCESS

Mathematics Studio Program Activities

Graduate Courses and Seminars

Knowing Mathematics for Teaching (KMT)
- 6 KMT graduate math courses for K-12 teachers – based on OMLI math content courses.
- Co-taught by teams of higher education faculty & master teachers from the OMLI project

Best Practices in Teaching Mathematics (BP)
- Annual 30-hr graduate seminars focused on evidence-based math pedagogy
- All teachers develop action plans for improving their teaching practices
- Action Plans are implemented and evolve throughout the year
- Years 3 & 4 emphasizes internships for local leaders who learn to lead this seminar

Instructional Leadership in Mathematics
- Annual seminars for school and district administrators, focusing on:
  - Developing a leadership voice for mathematics
  - Analyzing math teaching
  - Organizing schools for math learning

Collegial Leadership in Mathematics
- Annual seminar for math specialists, coaches, & lead teachers
- Focuses on transition to local leadership of Studio-related professional development

Online Professional Development
- Online workshops to deepen KMT/BP content and pedagogy – taught by OMLI project faculty.

Classroom Studios *(implementing Best Practices learning in "real time")*

Five three-day Studio Cycles per year per school:
- .5-day of one-to-one leadership coaching for Studio principal as the building's "lead learner"
- .5-day of inquiry/prep with the Studio teacher
- One Studio Day during which all math teachers and the principal use the Studio Classroom as context for planning/rehearsing, enacting ("live" with students), and debriefing "mathematically productive" teaching practices learned during the Best Practices seminar
- One day of additional one-to-one coaching for selected teachers/coaches from the school

Studio school is the unit of change (involves all math teachers)

Pre-service teachers/supervisors attend selected Studios

Year 3 transitions to side-by-side coaching for local leadership of Classroom Studios

As a studio matures, it becomes a "greenhouse" site for seeding new studios across the district

Leadership Studios

- School Leadership studios are for job-alike groups of school leaders (e.g., principals, district office administrators, coaches) learning about school leadership and KMT Leadership Studios are for higher education faculty learning about effective mathematics pedagogy
- Leaders/faculty receive coaching during the planning and rehearsal, "live" enactment, and debrief of specific "mathematically productive" leadership strategies relevant to their leadership roles and needs (e.g., staff/team meeting, principal meeting, 1-1 teacher conference, math coaching session, classroom walk-through, KMT course instruction).

Online Math Collaboratives

Studio participants use these online sites to:
- Reflect between cycles in their private Online Teaching Journals
- Engage in open-forum discussions about implementation successes/challenges
- Post/interact about student learning data
- Expand/refine their Action Plans
- Upload/retrieve artifacts, tools, resources, and between-cycle

Data Retreats

- Annual year-end event
- Analyze/share data for evidence of success
- Develop school data plans for coming year
- Part 1, at the building level, includes the Studio principal, math specialists/coaches, and all math teachers
- Part 2, at the district level, includes the principal and a teacher-leadership team

Outcomes Needed for Student Success

All Students Engage Regularly in Productive Mathematical Practices

All teachers are consistent and effective in using research-based teaching practices that assure high-cognitive engagement by all students in cognitively demanding math tasks. Through such teaching practices, all teachers engender productive and habitual use of the following Mathematical Practices by all students:
- ***Providing explanations***
- ***Making justifications***
- ***Formulating conjectures & generalizations***
- ***Using multiple representations***
- ***Engaging in metacognition***
- ***Connecting ideas and representations***

Generative, Self-Sustaining Mathematics Professional Learning

Increased Specialized Content Knowledge

Teachers do and study mathematics together regularly as adult mathematical thinkers to increase their specialized content knowledge

Increased Mathematics Professional Development Capacity

Broad base of instructional leaders (teachers and administrators) that share responsibility for continuous improvement through effective practice-based mathematics professional learning

Institutionalized Mechanism For Continuous Improvement in Math Instruction and Achievement
- Specific, well-defined, school-based roles and responsibilities
- Well-defined professional learning experiences for individuals in each role
- Research-based tools and strategies that support effective implementation of roles, responsibilities, and professional learning

SUCCESS

Increased Student Achievement

The percentage of students who demonstrate proficiency on the state mathematics assessments increases compared to that of comparison schools

Increased Mathematics Pursuits

Enrollment and success in challenging and advanced high school mathematics courses increases

Decreased Achievement Gaps

The achievement gap for traditionally under-achieving demographic subgroups decreases compared to that of comparison schools

Sustainable Infrastructure

School and district policies and procedures support and sustain the Math Studio Program as an institutionalized context for professional learning and continuous improvement.

IDENTIFYING AND ADDRESSING KEY CHALLENGES

CHALLENGE: PROFESSIONAL LEARNING FOR STUDENT SUCCESS

- OMLI evaluation research revealed that the degree to which schools implemented certain school-based professional learning practices were a significant positive predictor of student performance above and beyond what can be explained by socioeconomic factors.
- Most schools lack well-defined structures that support the "school as the unit of change," where ALL teachers of mathematics and their administrators work together on a regular and ongoing basis in ways that have continuous impact on all teachers' mathematics teaching and all students' mathematics learning.

ADDRESSING THE CHALLENGE

We expanded the OMLI logic model to create the Mathematics Studio Program, whose tools, structures, and activities incorporate the specific professional learning practices that were determined to be significant positive predictors of student performance. The Studio model is making a difference in high need settings. For example:

Fremont Middle School • Roseburg School District • Roseburg, OR
Students Meeting/Exceeding Standard on the Oregon Assessment of Knowledge & Skills - Math

Year	2004-05 (*typical of prior yrs*)	2005-06 *OMLI*	2006-07 *OMLI*	2007-08 *OMLI Some BP*	2008-2009 *Some BP 2 in Studio*	2009-2010 *All math & SPED teachers take BP, Studio, & KMT Math together*
						SPED students in regular math
All Students	30.8%	49.8%	56%	70%	76.04%	83.62%
Special Ed.	13%	17.7%	20.9%	20.2%	30.34%	57.01%

Harrison & Sierra Vista Middle Schools • Sunnyside School District • Sunnyside, WA
Washington Statewide Mathematics Assessment
Student Cohort end of Grade 5 (2008) to end of Grade 7(2010). First two years in the Math Studio Program.

Level 1	37 % of students at Level 1 in Gr. 5 improve 1 or more levels by Gr. 7 (*comparison schools @ <20%*)
Level 2	Over 50% of students at Level 2 in Gr. 5 perform at Levels 3 or 4 in Gr. 7 (*comparison schools @ 28%*)
Levels 3 & 4 *Meets/ Exceeds*	4% declined to Levels 1 or 2 (comparison schools @38%)

"In prior years, while there were spots of improvement at the other middle schools, it was not seen as consistently across the schools as in the studio sites. However, after one year of all middle schools' involvement in studio work, the district enjoyed record achievement at the middle level: nearly 82% of all middle school students and 50% of SPED middle school students met or exceeded standard on the Oregon statewide assessment." (2010, Bill Rhoades, Chief Academic Officer, Bend-LaPine School Dist., Bend, OR)

Sunnyside School District Meet/Exceed Standard		
Grade	2008	2010
6	19.3%	31.9%
7	30.1%	43.9%
8	25.7%	41.7%

CHALLENGE: STUDENT MATHEMATICAL DISCOURSE

- Our 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 and students what constitutes a justification and generalization, especially the differences between students explaining **how** and justifying **why**.
- **ADDRESSING THE CHALLENGE** To develop understanding, we adapted the research observation protocol to create tools for productive peer observations and to foster student attention to their developing use of productive mathematical practices. Two examples are shown here:

Teacher _____ Grade/Class _____ Date _____ Page ____ of ____

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

- **Our evaluation research indicates that regular use of professional learning tasks and teaching that center on productive, high-cognitive student mathematical discourse is positively correlated with students' math achievement. The studio model attends relentlessly with teachers, students, and administrators to the quality and quantity of student mathematical discourse.**

Name: _____ **Date:** _____

STUDENT REFLECTION TOOL: MATHEMATICAL HABITS-OF-MIND

Use the following scale to rate your use of Mathematical Habits-of-Mind.

0 — Never/Hardly ever; 1; 2 — Sometimes; 3; 4 — It's just how I do math!

Mathematical Habits-of-Mind	Rating: 0,1,2,3,4	Evidence
a) I show/explain **how** I reason and make sense of math ideas and problems.		
b) I use math to **justify why** ideas and answers do or don't work.		
c) I make and test mathematical **conjectures** and **generalizations.**		
d) I use **multiple representations** – models, diagrams, graphs, numbers, words, math symbols, and situations from everyday life – to make sense of math ideas and problems.		
e) I use **metacognition** – I think about my own mathematical thinking, ways my ideas compare to other ideas, and ways my understanding is developing		
f) I make **connections** between math representations, to other math ideas, to other		

OUR CONTINUING CHALLENGES AND QUESTIONS ABOUT STUDENT SUCCESS:

In terms of student learning, how do we determine the "key ingredients" of this studio model? On which factors do we focus research? What is the grain size for our research?
- **What are the highest leverage (i.e., most mathematically productive) instructional and leadership practices?**
- **What are the highest leverage mathematical practices (i.e., student habits-of-mind)?**

What are the most affordable, rigorous, revealing, and reliable tools/strategies for measuring implementation of students' mathematical practices, teachers' instructional practices, and administrators' leadership practices?

OUR PARTNERS AND THEIR ROLES IN STUDENT SUCCESS

TEACHERS DEVELOPMENT GROUP
- Design, development, leadership, and delivery of the professional development model, tools, and practices

OREGON STATE UNIVERSITY & PORTLAND STATE UNIVERSITY
- Math content instruction for teachers, course development
- Also supported by Pacific University, Washington State University, Linfield College, Worcester State College, University of Portland, and Central Oregon, Linn-Benton, & Umpqua Community Colleges

EDUCATIONAL SUPPORTS, INC. & RMC RESEARCH, INC.
- Evaluation & Research

BEND-LA PINE SCHOOL DISTRICT • Bend, Oregon
HIGHLINE SCHOOL DISTRICT • Burien, Washington
MEDFORD SCHOOL DISTRICT • Medford, Oregon
ROSEBURG SCHOOL DISTRICT • Roseburg, Oregon
SHERWOOD SCHOOL DISTRICT • Sherwood, Oregon
SUNNYSIDE SCHOOL DISTRICT • Sunnyside, Washington

These are high needs school districts that have committed to our project research during implementation of the Math Studio Program .