Paper Session 1

Monday, January 23, 2012
11:10 a.m. - 12:45 p.m.
Summaries on Pages 16-18, Abstracts on Flash Drives

Breakout Room 2:   **Discussant: Louis J. Everett**

Defining Effective Mathematics Teachers: How Can Professional Development Promote Evidence-Based Definitions?

Zenaida Aguirre-Munoz   Strand: 1
WT Middle School Math Partnership

The Role of Vocabulary in "Inquiry" Science Instruction for English Language Learners

Andrew Elby   Strand: 1
Minority Student Pipeline MSP

Breakout Room 3:   **Discussant: Melissa Reeves**

Infusing Issues in Sustainability Science Across the Curriculum to Motivate Improved Teaching and Learning in STEM

Stephen Madigosky   Strand: 1
ES(2)

Bridging Research and Knowledge to Application in an Effort to Improve and Refine Strategic Goals, Program Implementation, and Evaluation Methods

Nisaa Kirtman   Strand: 1
Project MAST

Breakout Room 4:   **Discussant: Richard W. Peterson**

Refining Learning Progressions in Astronomy and Plate Tectonics in the Middle Grades

Scott McDonald   Strand: 1
Middle Grades Earth and Space Science Education Partnership

Assessing the Impact of Cross-Cutting Science Concepts on Teacher Effectiveness in the 3-8 Classroom

Abigail Levy   Strand: 3
Boston Energy in Science Teaching (BEST)

Breakout Room 5:   **Discussant: Lance C. Pérez**

Development and Implementation of a Year-long High School Engineering Course

David Allen   Strand: 2
UTeachEngineering

Promoting Effective Elementary STEM Teaching through Engineering Design in Grades 3 through 6
Brenda Capobînco   Strand: 2
Science Learning through Engineering Design (SLED)

Breakout Room 6:   **Discussant: Felicia Martin**

Several Models of Preparing and Supporting STEM Faculty to Teach Effectively

Joan Karp   Strand: 2
Boston Science Partnership

How Can STEM Faculty Become Effective in the Advanced Training of Teachers?

Erin Militzer   Strand: 2
Arizona Teacher Institute

Paper Session 1

Monday, January 23, 2012
11:10 a.m. - 12:45 p.m.
Summaries on Pages 18-20, Abstracts on Flash Drives

Breakout Room 7:   **Discussant: Wendy Smith**

Supporting Inservice K-8 Mathematics Teachers: The Vermont Mathematics Partnership's Frameworks for Strengthening Content Knowledge

Douglas Harris   Strand: 2
Vermont Mathematics Partnership

Evolution of a Partnership Engagement Project in the Appalachian Mathematics and Science Partnership:Lessons Learned

David Royster   Strand: 2
Appalachian MSP

Breakout Room 8:   **Discussant: Todd Ullah**

Teacher Motivation in Professional Development - Results from a National Sample

Stuart Karabenick   Strand: 2
Motivation Assessment Program II (MSP-MAP II)
Teacher Motivation in Professional Development

MOSART: Examining SMK and PCK with Modern Psychometric Analysis

Philip Sadler   Strand: 2
MOSART-LS

Breakout Room 9:   **Discussant: Elizabeth VanderPutten**

STEM Teaching Effectiveness: A Synthesis of Perspectives

James Madden   Strand: 2
Louisiana Math and Science Teacher Institute

Using Teacher Assignments to Measure the Rigor and Relevance of Middle School Mathematics Instruction

Jamie Shkolnik   Strand: 3
Impact of MSP Professional Development on the Quality of Instruction in Middle-School Mathematics Classrooms

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Breakout Room 10:   **Discussant: Brian Drayton**

Feedback for Improving Teaching and Learning

Cathy Kinzer   Strand: 2
Mathematically Connected Communities - Leadership Institute for Teachers

Task Analysis: A Process of Documenting Task-Level PCK

Frieda Parker   Strand: 2
Math TLC

Breakout Room 11:   **Discussant: James E. Hamos**

Collaborative Development of Biology and Geology Content Courses for Future Elementary and Inservice Teachers
George Nelson   Strand: 2
NCOSP

Development and Implementation of Learning Progression-based Teaching Strategies (LPTSs) for Environmental Science
Alan Berkowitz   Strand: 2
Culturally Relevant Ecology, Learning Progressions and Environmental Literacy (LTER)

Paper Session 1

Monday, January 23, 2012
11:10 a.m. - 12:45 p.m.
Summaries on Pages 21-23, Abstracts on Flash Drives

Breakout Room 12:   **Discussant: Kathleen B. Bergin**

Supporting Inquiry-rich Teaching through Professional Development within a District-Higher Education Partnership **Joshua Caulkins** Strand: 2 RITES	*"Equity Practices" for Teaching and Student Learning: How to Go Below the Surface of the Words* **Thomas Philip** Strand: 2 MOBILIZE: Mobilizing for Innovative Computer Science Teaching and Learning

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Breakout Room 13:   **Discussant: Joan T. Prival**

NebraskaMATH: Getting it Right from the Start: Supporting Effective Instruction in the Primary Grades **Michelle Homp** Strand: 2 NebraskaMATH	*A Decade-Long Effort to Improve the Teaching of K-12 Mathematics in Rapid City, South Dakota* **Ben Sayler** Strand: 3 PRIME

Breakout Room 14:   **Discussant: Pamela Brown**

Learning Together: A User-Friendly Tool to Support Research on STEM Education Interventions Research **Joan Pasley** Strand: 3 Knowledge Management and Dissemination	*Data Connections: Methodology for Developing Student Achievement Trajectories to Estimate Teaching Effectiveness* **Jennifer Green** Strand: 3 Data Connections

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Breakout Room 15:   **Discussant: Ron Buckmire**

Conceptually-rich Mathematics Coaching: Will Mathematics Specialists Put Into Practice What They Have Learned? **Aimee Ellington** Strand: 3 Preparing Virginia's Mathematics Specialist	*Effective Teaching in Middle School Mathematics* **John Mayer** Strand: 3 Greater Birmingham Mathematics Partnership

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Breakout Room 16:   **Discussant: Lee L. Zia**

Qualitative Analysis of Changes in Teachers' Knowledge, Beliefs and Classroom Practices Based on Three Years of Professional Development **Carol Baldassari** Strand: 3 Focus on Mathematics	*Evidence of Enhanced Teaching in Student Content Knowledge Gains: Missouri's A TIME for Physics First MSP* **Keith Murray** Strand: 3 A TIME for Physics First in Missouri

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Paper Session 1 – Summaries

Breakout Room 2:

Defining Effective Mathematics Teachers: How Can Professional Development Promote Evidence-Based Definitions?

Zenaida Aguirre-Munoz, WT Middle School Math Partnership, Strand: 1

SUMMARY: The theoretical model that underlies the West Texas Middle School Math Partnership addresses: (1) conceptual understanding of the math taught in middle school, (2) knowledge for teaching math; (3) teaching self-efficacy; and (4) culturally and linguistically sensitive instruction. Thus, effective teaching in mathematics from this perspective involves a focus on conceptual understanding utilizing instructional practices that address students' cultural and linguistic needs as well as interaction patterns that promote positive student self-efficacy of mathematics content learning. Evidence in support of the theory of action was found. Teachers' conceptual mathematical knowledge, content knowledge for teaching, and self-efficacy has grown consistently. Improvements in culturally and linguistically sensitive instruction have lagged behind. Implications are discussed and lessons learned are presented.

The Role of Vocabulary in "Inquiry" Science Instruction for English Language Learners

Andrew Elby, Minority Student Pipeline MSP, Strand: 1

SUMMARY: Researchers disagree about how best to introduce vocabulary to English language learners (ELLs) to facilitate inquiry discussions. Some advocate frontloading vocabulary, so that ELLs can express themselves more easily. Others advocate letting ELLs begin discussions using whatever words they have available, and introducing vocabulary responsively, when students request it to express an idea. The data underlying this debate, however, has mostly been teacher reflections and field notes, not videotaped classroom episodes subjected to fine-grained analysis. Our videotaped examples of ELLs engaging in inquiry suggest the ELLs can engage productively in inquiry without frontloaded vocabulary. In fact, frontloading vocabulary can have the unintended side effect of reinforcing students' framing of science as words to learn rather than ideas to hash out.

Breakout Room 3:

Infusing Issues in Sustainability Science Across the Curriculum to Motivate Improved Teaching and Learning in STEM

Stephen Madigosky, ES(2), Strand: 1

SUMMARY: Improving science education is essential to improving global human sustainability. Sustainability Science, which spans the interface of natural and social systems, provides creative new methods for analyzing human Earth ecosystems and engineering a 21st Century green economy. Our theory of action extends these approaches into the domains of STEM education. Our project will create a multi-school district network of professional learning communities (semi-formally organized in a multi-university matrix of course offerings, certificates, and a master's degree in Sustainability Science Education) that will design and implement new and innovative curricula that infuses project-based sustainability issues into STEM courses across the curriculum. We suggest that these infusions will cause students to learn because learning is driven by motivation to learn and sustainability is relevant, engaging, interdisciplinary, and brings a novel approach to learning in STEM.

Bridging Research and Knowledge to Application in an Effort to Improve and Refine Strategic Goals, Program Implementation, and Evaluation Methods

Nisaa Kirtman, Project MAST, Strand: 1

SUMMARY: The Mississippi Academy for Science Teaching (Project MAST) is a professional development program intended to provide high school science teachers with the content and pedagogy necessary to teach the state's physical science standards. Halfway through the project, MAST staff and evaluators revisited their original strategic plan; an activity termed the Teacher Effectiveness Action White Paper Project. The TEAWPP defines what MAST is, based on the strongest alignment between the proposed theory of action, the professional development literature, and empirical evidence of the program's implementation and outcomes. Locating the program within the larger literature base helped illustrate the critical components of MAST that lead to better teaching. The TEAWPP protocol can serve as an evaluation model and help inspire program revisions.

Paper Session 1 – Summaries

Breakout Room 4:

Refining Learning Progressions in Astronomy and Plate Tectonics in the Middle Grades

Scott McDonald, Middle Grades Earth and Space Science Education Partnership, Strand: 1

SUMMARY: The Middle Grades Earth and Space Science Partnership defines effective STEM teaching in terms of three criteria: 1) it targets big ideas in science, not topics; 2) it is organized around a coherent content storyline; and 3) it engages students to develop understandings of both science content and the practices of science. As part of the project's effort to define effective teaching we are developing learning progressions in Astronomy, Plate Tectonics, Climate and Energy. Learning progressions are "empirically grounded and testable hypotheses about how students' understanding of, and ability to use, core scientific concepts and explanations and related scientific practices grow and become more sophisticated over time, with appropriate instruction." We are in year two of our project.

Assessing the Impact of Cross-Cutting Science Concepts on Teacher Effectiveness in the 3-8 Classroom

Abigail Levy, Boston Energy in Science Teaching (BEST), Strand: 3

SUMMARY: The Boston Energy in Science Teaching (BEST) project is researching the impact that concept-based professional development (PD) has on teacher effectiveness compared to the discipline-based PD that was offered through the Boston Science Partnership (BSP). We have recruited grade 3-8 teachers who participated in BEST PD, BSP PD, and both. We will analyze data collected through teacher interviews and surveys, energy assessments for teachers and students, and classroom observations. We will compare data across groups to determine if there are differences in instruction and student achievement that correlate with the PD that teachers participated in. We therefore will be able to say if helping teachers make connections across science disciplines via concept-based PD results in more efficient and effective instruction.

Breakout Room 5:

Development and Implementation of a Year-long High School Engineering Course

David Allen, UTeachEngineering**,** Strand: 2

SUMMARY: The UTeachEngineering Program has developed a year-long high school Engineering Design and Problem Solving course that can be used to satisfy part of the science requirement for students graduating from high schools in Texas. The course is now in its second year of pilot testing in a diverse group of high schools. This session will describe the curriculum, the development and testing of the curriculum, and the professional development provided to teachers delivering the curriculum. Plans for continued modifications and dissemination of the curriculum will also be described.

Promoting Effective Elementary STEM Teaching through Engineering Design in Grades 3 through 6

Brenda Capobianco, Science Learning through Engineering Design (SLED)**,** Strand: 2

SUMMARY: The Science Learning through Engineering Design (SLED) Partnership is a new targeted project aimed at improving student learning of science and math at the elementary/intermediate school level through the integration of engineering design-based activities. The SLED project seeks to develop a framework for effective STEM teaching through engineering design to support educational change and innovation among 200 inservice and 100 preservice teachers and 5,000 students over five years. Progress to date has focused on creating the SLED community through shared information on instructional and curricular issues, development and implementation of content-rich design tasks, professional development for inservice teachers, creation of a design-based methods course for preservice teachers, and preliminary interactions within/across the community.

Paper Session 1 – Summaries

Breakout Room 6:

Several Models of Preparing and Supporting STEM Faculty to Teach Effectively

Joan Karp, Boston Science Partnership, Strand: 2

SUMMARY: The Boston Science Partnership (BSP Phase I &II) has provided a variety of forms of preparation and support for STEM faculty at institutions of higher education centered on effective teaching. Many of these forms can be considered types of Professional Learning Communities (PLCs), some for STEM faculty only, and some also involving K-12 teachers. Evaluation findings have shown that STEM faculty involved in these activities report increased understanding of teaching practice, interest in and ability to implement student-centered learning practices and greater awareness of the entire STEM educational pathway from K-12 to college. They report changes in student performance and changes to departmental culture related to issues of pedagogy.

How Can STEM Faculty Become Effective in the Advanced Training of Teachers?

Erin Militzer, Arizona Teacher Institute, Strand: 2

SUMMARY: We will report on our efforts to prepare mathematics faculty to effectively teach inservice middle and elementary school teachers. Our speakers will include mathematicians who have taught the mathematics content courses along with those who have co-taught an educational research based class on student learning, Research on the Learning of Mathematics. Our session addresses the important challenge of how one prepares the typical STEM faculty member (one who has not worked in mathematics education) for the atypical experience of teaching middle school level mathematics to experienced schoolteachers. In our session, we will first outline a series of key issues related to STEM faculty teaching courses for middle school teachers and include examples of the innovative support faculty members have received when preparing for and teaching the content courses.

Breakout Room 7:

Supporting Inservice K-8 Mathematics Teachers: The Vermont Mathematics Partnership's Frameworks for Strengthening Content Knowledge

Douglas Harris, Vermont Mathematics Partnership, Strand: 2

SUMMARY: The Vermont Mathematics Partnership (VMP) has developed a conceptual framework and set of protocols to inform planning to support teachers and leaders at the classroom, school, and system levels. The planning protocols are based on three antecedents: the Professional Development Model and accompanying materials developed by Kenneth Gross and the Vermont Mathematics Initiatives; the VMP Equity Framework based on Rachel Lotan's work related to equity and complex instruction; and the Diagnostic Classroom Observation materials and protocols developed by Nicole Saginor of The Vermont Institutes and Paul Decker and Amy Johnson of Mathematica, Incorporated. These are described and related to lessons learned through intensive work with successful and less successful school and district partners.

Evolution of a Partnership Engagement Project in the Appalachian Mathematics and Science Partnership: Lessons Learned

David Royster, Appalachian MSP, Strand: 2

SUMMARY: The AMSP's model of STEM K-12 /Higher education engaged partnership, the Partnership Engagement Project (PEP), is in its sixth administration. Using NSF's DIO Cycle of Evidence of formative evaluation, seven modifications have been incorporated into the current model. The modifications include: assistance in writing professional development plans, analyzing data, creating a toolkit for programmatic evaluations, development of a district needs survey, and locating STEM higher education faculty to collaborate in planning and implementation. Due to geographic isolation inherent in rural districts and the difficulty of making IHE connections, we propose to use the AMSP local master teacher as an intermediary between IHE faculty and school districts. The intermediary serves as a bridge between these two cultures and offers a support mechanism for the reform effort.

Paper Session 1 – Summaries

Breakout Room 8:

Teacher Motivation in Professional Development - Results from a National Sample

Stuart Karabenick, Motivation Assessment Program II (MSP-MAP II) Teacher Motivation in Professional Development, Strand: 2

SUMMARY: Teacher professional development (PD) is an essential feature of instructional interventions in general, and for the improvement of students' math and science learning and achievement in particular. The more motivated teachers are to participate and engage in PD, the more likely they will be to profit from the experience. When teachers benefit, they are more likely to enact the PD approaches, content, and skills in their classrooms. Informed by theory and research on student and teacher motivation, a national study of teachers (n = 552) examined the level of teachers' motivation for PD (PDM), teachers' experiences in PD, and perceived benefits of PD, as well as associations with features of PD programs, teacher factors, and contextual factors.

MOSART: Examining SMK and PCK with Modern Psychometric Analysis

Philip Sadler, MOSART-LS, Strand: 2

SUMMARY: MOSART assessments are unique in measuring teachers' Subject Matter Knowledge (SMK) and Pedagogical Content Knowledge (PCK). This session will focus on how both types of knowledge contribute to effective teaching and learning. Because of these assessments' objectivity and validity, instructional sensitivity can be probed. Prior research of teachers' knowledge of student misconceptions enhances students' gains in understanding the science represented in items. New analyses of our MOSART test items use Item Response Theory (IRT) to examine the relationship of students' answers to the proficiency of students ranging in performance level. These analyses further extend the power of MOSART tests to support the work of MSPs to enhance teacher SMK and PCK.

Breakout Room 9:

STEM Teaching Effectiveness: A Synthesis of Perspectives

James Madden, Louisiana Math and Science Teacher Institute, Strand: 2

SUMMARY: Our presentation includes contributions from the lead designer of the physics curriculum (Slezak), cognitive scientists studying teacher expertise (Fisher, Lane and Matthews), the external project evaluator (Meyer), a teacher who has investigated transfer to classroom practice (Alphonso) and the project director (Madden). We give several different but related perspectives on the problem of delivering and evaluating university-based academic work that impacts the effectiveness of STEM instruction. The perspectives are brought together in our conceptual framework, which identifies the expected pathways of influence from the academic program to the classroom and distinguishes these pathways from other factors that impact classroom work. Partnership activities promote consonance between the academic program and school-based classroom demands.

Using Teacher Assignments to Measure the Rigor and Relevance of Middle School Mathematics Instruction

Jamie Shkolnik, Impact of MSP Professional Development on the Quality of Instruction in Middle-School Mathematics Classrooms, Strand: 3

SUMMARY: This presentation will illustrate the use of teacher assignments for examining the quality of instruction of middle school mathematics teachers who received MSP-provided professional development and similar teachers who did not. The presentation will explain how carefully developed scoring rubrics and the Many-Facet Rasch model can be applied to measuring the quality of teacher assignments and how the scoring process can be effectively managed by using the Access-based Teacher Assignment Scoring System. This presentation will also demonstrate how measures of assignment quality can be properly analyzed using an advanced analytic method--HLM latent variable modeling, and report preliminary findings. We hope that these under-utilized measurement tools will become part of an expanding repertoire of methodological tools for STEM education researchers.

Paper Session 1 – Summaries

Breakout Room 10:

Feedback for Improving Teaching and Learning

Cathy Kinzer, Mathematically Connected Communities - Leadership Institute for Teachers**, Strand: 2

SUMMARY: Mathematicians, mathematics educators, researchers, and K-12 teachers at New Mexico State University involved in the Leadership Institute for Teachers (LIFT) collaboratively design and improve mathematics lessons and coursework in the two-year institute. Reflective feedback is a central strategy to think about what we do, how we communicate, and what we learn. Specific tools and strategies are strategically used throughout the semester to provide data /feedback to teacher leaders and instructors in the LIFT courses. The feedback is used over time in developing a learning system that values stakeholder voice and focuses on what and how we learn. The feedback strategies and tools provide evidence to take action for improving learning.

Task Analysis: A Process of Documenting Task-Level PCK

Frieda Parker, Math TLC, Strand: 2

SUMMARY: In this presentation, we describe the task analysis process, which is a tool we developed to support teachers systematically thinking about and articulating the pedagogical content knowledge (PCK) for teaching a rich math task. A complete task analysis includes: the mathematics embedded in the task, including an appropriate range of strategic approaches and correct answer(s); pedagogical moves and tools/technology that could support student thinking about the mathematics embedded in the task; mathematical difficulties and misconceptions students might face while engaging with the task; and content and process standards that could be addressed with the task. The task analysis process can be used to support lesson planning, as a coaching or mentoring tool, and as an activity in professional development.

Breakout Room 11:

Collaborative Development of Biology and Geology Content Courses for Future Elementary and Inservice Teachers

George Nelson, NCOSP, Strand: 2

SUMMARY: The North Cascades and Olympic Science Partnership (NCOSP), in partnership with California State University Chico (in biology) has developed and implemented semester-long courses in biology and geology based on the model provided by Physics and Everyday Thinking (Goldberg et.al. 2006) which incorporates the research base described in How People Learn (NRC 2000). The sequence of courses is offered for future teachers at Western Washington University and three community colleges. The biology materials have been adapted for use in high schools in two school districts. More than five years of evaluation data indicate that the courses are effective in helping future teachers learn important content through instruction that explicitly models effective teaching practices. A five-year longitudinal research study was recently funded.

Development and Implementation of Learning Progression-based Teaching Strategies (LPTSs) for Environmental Science

Alan Berkowitz, Culturally Relevant Ecology, Learning Progressions and Environmental Literacy (LTER), Strand: 2

SUMMARY: Our Targeted Partnership, Culturally Relevant Ecology, Learning Progressions and Environmental Literacy, is centered on four Long Term Ecological Research sites: Baltimore, Maryland (urban); Kellogg Biological Station, Michigan (agro-ecosystems); Ft. Collins, Colorado (short grass steppe); and Santa Barbara, California (land/ marine ecosystems). Each site is working with middle and high school science teachers to enhance environmental science teaching. We describe the development and use of research-based learning progressions to explore how students and teachers learn environmental science in strands focusing on carbon cycling, evolution and biodiversity, and water systems. We then discuss the place-based, culturally-responsive models of professional development we have created and tested to support the use of learning progression-based teaching strategies in the diverse classrooms encompassed by our multi-site project.

Paper Session 1 – Summaries

Breakout Room 12:

Supporting Inquiry-rich Teaching through Professional Development within a District-Higher Education Partnership

Joshua Caulkins, RITES, Strand: 2

SUMMARY: There is a need for instructional materials to help teachers enact inquiry-rich science in their classrooms. Technology-enhanced investigations can provide students with opportunities to collect data using probeware and investigate natural systems through models and simulations. The RITES partnership is a statewide collaboration between grade 6-12 schools and higher education to develop inquiry-rich activities addressing state standards and to provide meaningful learning opportunities for Rhode Island students. A challenge faced within the partnership is how to design PD that helps teachers use RITES materials effectively. This study describes the design of 16 PD short courses attended by approximately 100 teachers. We used course evaluations, pre/post assessments, short course observations and interviews to determine how teachers benefited from the PD.

"Equity Practices" for Teaching and Student Learning: How to Go Below the Surface of the Words

Thomas Philip, MOBILIZE: Mobilizing for Innovative Computer Science Teaching and Learning, Strand: 2

SUMMARY: Our model of "effective teaching in STEM" addresses inquiry-based instruction, equity in teaching and learning, and computational thinking concepts. We will discuss what equity practices mean for teaching and learning, especially in the context of a classroom project based on technology/computational thinking. We ask how to integrate our critical perspective about the purposes of technology, schooling, and STEM education into our work with teachers. We question how to turn our theory about schools reproducing inequitable and unjust processes, and the current myths about technology as the great equalizer, into alternative practices with teachers. Within the larger context of a "culture of power," we examine our own approaches to helping teachers develop effective methods for encouraging students to see themselves as capable "doers" of STEM.

Breakout Room 13:

NebraskaMATH, Getting it Right from the Start: Supporting Effective Instruction in the Primary Grades

Michelle Homp, NebraskaMATH, Strand: 2

SUMMARY: We will share information about coursework and study groups for K-3 teachers becoming K-3 Mathematics Specialists in Nebraska. We discuss how we have refined our courses and study groups over time, and how we are focusing on helping teachers to become more intentional, planful, observant, and reflective mathematics teachers. We also share one presenter's perspective in the dual role of a K-3 district math coach and course instructor, and what she sees as necessary to support K-3 teachers to teach math more effectively. We also discuss the role of K-3 teacher leaders in a distributed leadership model to support more effective math teaching statewide.

A Decade-Long Effort to Improve the Teaching of K-12 Mathematics in Rapid City, South Dakota

Ben Sayler, PRIME, Strand: 3

SUMMARY: Now in its 10th year, Project PRIME has assembled a wide array of evidence, both direct and indirect, about improved teaching of mathematics within Rapid City Area Schools. Direct evidence exists in the form of classroom observations conducted over the life of the project by PRIME's external evaluation team, Inverness Research. Indirect evidence exists in the form of student outcomes: Achievement on state test; achievement on a more performance-oriented test; and student attitudes. A powerful story is emerging, attributable largely to a robust infrastructure that has been established to support teacher growth. The session will share how far the district has come, factors contributing to success, obstacles along the way, persistent challenges, and the path ahead.

Paper Session 1 – Summaries

Breakout Room 14:

Learning Together: A User-Friendly Tool to Support Research on STEM Education Interventions Research

Joan Pasley, Knowledge Management and Dissemination, Strand: 3

SUMMARY: The MSP KMD project is charged with situating what MSPs are learning in the broader knowledge base. MSP KMD has developed a "User-Friendly Tool" to provide a common language for project teams with varying research backgrounds to discuss their STEM education research. The tool describes key considerations in designing and reporting research on STEM education interventions, includes reflection questions for research teams to use when considering their research designs, and illustrates the use of the tool with sample research designs. The LNC session will engage participants in using this tool with a hypothetical research design for studying the impact of an MSP intervention on STEM teaching. Participants will also consider implications of this tool for their own MSP research.

Data Connections: Methodology for Developing Student Achievement Trajectories to Estimate Teaching Effectiveness

Jennifer Green, Data Connections, Strand: 3

SUMMARY: While effective teaching is conceptualized broadly, statistical modeling is one approach to identify teaching which induces growth in student achievement that exceeds expectations. In particular, one tool for measuring the impact of MSP programs on teaching effectiveness is student achievement data. Detecting the impact of a MSP project on student achievement requires more than a single snapshot of student performance. Instead, a coherent picture of student progress is needed before, during and after a project's initiation. However, the data available to projects often do not meet the technical requirements of current statistical methods. This project is investigating the use of new methods to analyze less-than-ideal data. These methods and their applicability to MSP projects will be discussed in this session.

Breakout Room 15:

Conceptually-rich Mathematics Coaching: Will Mathematics Specialists Put Into Practice What They Have Learned?

Aimee Ellington, Preparing Virginia's Mathematics Specialist, Strand: 3

SUMMARY: With respect to the education of Mathematics Specialists, effective STEM teaching involves presenting K-8 mathematics ideas in ways that help our MSP Institute participants develop a rich conceptual understanding of the content and develop a deep understanding of how children learn mathematics. In this session, we will describe how our definition of effective STEM teaching is implemented in the courses participants take in our program. We will present data from our initial visits to our participants' school buildings that address the questions: Are teachers preparing to be middle school Mathematics Specialists able to implement similar teaching strategies in their classrooms? And how will what they are learning and how they are teaching impact them when they assume roles as mathematics coaches?

Effective Teaching in Middle School Mathematics

John Mayer, Greater Birmingham Mathematics Partnership, Strand: 3

SUMMARY: The Greater Birmingham Mathematics Partnership (GBMP), through Phase I and II MSP awards, has focused its support and study on effective teaching of middle school mathematics (grades 5-8). Our approach to effective teaching in mathematics can be fit to an MSP logic model. Conditions involve partner commitments to summer courses, school-based PLCs, Community Math Nights, Administrator sessions emphasizing what inquiry-based instruction looks like, and Math Support Teams (MSTs) in the schools. Activities involve summer courses modeling inquiry-based pedagogy, support for inquiry-based teaching in the classroom, PLCs, coaching MSTs, and guidance in facilitating good PLC meetings. Outcomes include classroom observations showing increased implementation of inquiry-based instruction, and relating this to improved student achievement as measured by both aligned and unaligned instruments.

Paper Session 1 – Summaries

Breakout Room 16:

Qualitative Analysis of Changes in Teachers' Knowledge, Beliefs and Classroom Practices Based on Three Years of Professional Development

Carol Baldassari, Focus on Mathematics, Strand: 3

SUMMARY: This session presents methods researchers developed to collect and analyze data about how/ extent which FoM's 3-year masters' degree program deepens secondary mathematics teachers' MKT, beliefs about teaching and learning mathematics, and transfer of learning to their students. Methods include observations of PD sessions, review of teacher artifacts, interviews with teachers and faculty, classroom observations. The study focused on four secondary teachers; data was collected over 2-3 years; data analysis is currently being completed. Early analysis reveals the significant impact of contextual factors (school/district circumstances; teacher background/prior experiences) that bear on teacher learning and their influence on their work with students. This pilot study allowed researchers to develop and test research methodologies and to recognize the need for policy changes.

Evidence of Enhanced Teaching in Student Content Knowledge Gains: Missouri's A TIME for Physics First MSP

Keith Murray, A TIME for Physics First in Missouri, Strand: 3

SUMMARY: A TIME for Physics First, researching intervention effects on two cohorts of ninth-grade Missouri physics teachers, includes leadership building, content, pedagogy, research and evaluation components in its professional development model. Inquiry and modeling-based physics content in the classroom is emphasized. With a random-assignment, delayed-entry design, analysis of student pre/post physics content tests in the first treatment year permitted an early opportunity to confirm project assumptions that intervention would improve teaching and yield enhanced student achievement. Students of intervention teachers within one year after participation began showed statistically significant higher mean gains ($p < .000$, e.s. .53) compared to students of comparison teachers not yet participating, based on scores from the Test of Understanding Graphs-Kinematics. Teachers themselves experienced similar test results.