

Presentations and Abstracts for NSEC 2015 National Conference

Plenary Session Presentations

What We Know about STEM Education Centers and Their Intersection with Teacher Preparation

- **Noah Finkelstein**, Professor of Physics; Director of the Center for STEM Learning; and President's Teaching Scholar, University of Colorado at Boulder
- **Kacy Redd**, Director of Science and Mathematics Education Policy, APLU

Undergraduate Research Experiences

- [**Sarah L. Simmons**, Senior Program Officer, Science Education, Howard Hughes Medical Institute](#)
- **Anne-Barrie Hunter**, Co-director and Research Associate with Ethnography and Evaluation Research, and Program Manager, Center for STEM Learning, University of Colorado at Boulder
- [**John Keller**, Associate Professor, and CESaME Co-Director, California Polytechnic State University](#)
- [**Council on Undergraduate Research**](#)

Change in Higher Education: Improving Undergraduate STEM Teaching

- [**Eric Brewe**, Associate Professor of Science Education, and Associate Director of Research, STEM Transformation Institute, Florida International University](#)
- [**Charles Henderson**, Professor, Department of Physics and Mallinson Institute for Science Education, and Co-Director, Center for Research on Instructional Change in Postsecondary Education, Western Michigan University](#)
- [**Steven J. Pollock**, Professor, Physics, University of Colorado at Boulder](#)

Keynote Address in Queen Anne Ballroom

[Susan R. Singer, Division Director for Undergraduate Education, National Science Foundation, and Laurence McKinley Gould Professor, Carleton College](#)



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Concurrent Sessions**WORKSHOP: The Importance of Cross-Departmental Discussions and Trans-institutional Collaboration to Secure Faculty Buy-IN for Pedagogical Reform****Time:** Wednesday, June 3, 2015, at 9:30 AM - 11:40 AM**Location:** Queen Anne Ballroom**Authors:** Mathew L. Ouellett, Andrew Feig, Karen Myhr, and Peter Hoffmann, Wayne State University

Abstract: In this interactive workshop, teams will explore the pathways to success in campus-based instructional transformation efforts. These efforts require a common vision to be adopted by a diverse group of stakeholders. A lot has been written about the barriers to course reform. On the flip side, we wish to focus on the incentives that can be brought to bear, even in resource-limited environments such as Wayne State. We will discuss the efforts to engage faculty at Wayne State and determine if teams from diverse campuses can identify comparable strategies at their own institutions that can leverage their assets and take advantage of institutional networks beyond their own campus to motivate participation and faculty buy-in.

Land-Grant University Partnership with Rural Midwest Schools to Improve STEM Education**Time:** Wednesday, June 3, 2015, at 9:30 AM - 10:00 AM**Location:** Bienville**Authors:** Gina M. Kunz, Gwen Nugent, Jon Pedersen, James Houston, Irina Kalutskaya, and ChaoRong Wu, University of Nebraska-Lincoln

Abstract: CSI: Coaching Science Inquiry in Rural Schools is a professional development program for middle and high school science teachers in rural schools examined by the National Center for Research on Rural Education (R2Ed; IES grant # R305C090022), in the Nebraska Center for Research on Children, Youth, Families and Schools at the University of Nebraska-Lincoln. This two-year research study used a randomized controlled trial with 119 rural science teachers across 109 schools. It investigated the effects of technology-mediated instructional coaching focused on guided scientific inquiry. Multiple forms of innovative technologies were used to facilitate teacher professional development. The study examined the impact of teacher professional development with technology-delivered follow-up coaching (treatment) versus no professional development (control) on teacher and student inquiry outcomes. Partnerships extended to state Educational Service Units, currently exploring coaching models based on our study. The presentation will include coaching process video-clips and demonstration of other technologies used.

How We Improved Success Rates in Large General Chemistry Classes at the University of Utah**Time:** Wednesday, June 3, 2015, at 9:30 AM - 10:00 AM**Location:** Queen Anne Parlor**Authors:** Charles H. Atwood, Brock Casselman, and Braden Ohlsen, University of Utah

Abstract: Over the last three years we have diligently worked to discover and address issues that prevent Utah students from succeeding in our general chemistry program. Changes that we have made to the program in the last two years including a flipped classroom model, discussion section improvements, implementing prerequisites, and an increased understanding of student classroom and personal issues resulted in a 12% improvement in student success from Fall 2013 to fall 2014.

Concomitant improvements in the American Chemical Society standardized final exam have also been determined. For the fall 2014 cohort of ~950 students in three sections the average percentile was 80%. In this presentation we will show what steps we have taken over the last three years to increase our student success rate.

Community/Campus Partnership: Rural Pipeline for STEM professionals

Time: Wednesday, June 3, 2015, at 10:10 AM - 10:40 AM

Location: Iberville

Authors: Ann Chester, Cathy Morton, Mary McMillion, Sara Hanks, and Summer Kuhn, West Virginia University

Abstract: The Health Sciences and Technology Academy marshals the efforts of mentors -teachers, community members, and higher-education faculty, staff, and students- through a framework that provides academic rigor and personal support to 9th-12th graders facing social and financial challenges in furthering their education. Program goals are to increase college attendance, improve STEM education, empower communities through youth leadership development, and increase the number of STEM professionals in under-served communities. These students are 80% women, 73% first in their families to attend college, 63% financially disadvantaged, and 32% African American. Research projects are required each year beginning in the 9th grade and repeating through the 12th grade when they graduate from HSTA. We will discuss the outcomes and infrastructure needed for scientist-student collaborations in community engaged research. Over 2000 students have graduated from the program, 800 are currently matriculating, 99% graduate from college, 62% major in STEM and many earn advanced degrees.

Impact of High-stakes Testing on Biology Curriculum

Time: Wednesday, June 3, 2015, at 11:10 AM - 11:40 AM

Location: Bonnet Carre Room

Authors: Aressa Coley, Christina Hillesheim, and Ryan Walker, Mississippi State University

Abstract: The use of high-stakes tests in the United States has increased over the last few decades resulting in several unintended consequences; 1) increased pressure on teachers to improve scores, 2) a shift in attention from high achieving students to low achieving students, and 3) a narrowing of curriculum. Effective science teaching includes both science content and science process skills or inquiry. The threat of narrowed curriculum is that topics or skills not weighted as heavily on the test may be de-emphasized or ignored completely. Unfortunately in this situation, teachers' focus on factual knowledge rather than scientific thinking. Using a statewide longitudinal data system with over 490,619 student records, researchers analyzed the impact of high-stakes testing on the delivered biology curriculum. Results suggest that biology students are not receiving the intended biology curriculum. Researchers discuss the impotence of aligning state level assessments to accurately reflect the desired components of scientific literacy.

Curricular Touchstones for Secondary Methods Courses**Time:** Wednesday, June 3, 2015, at 11:10 AM - 11:40 AM**Location:** Queen Anne Parlor**Authors:** Sean Yee, University of South Carolina; Sam Otten, University of Missouri; and Megan Taylor, Stanford University

Abstract: Secondary mathematics education methods courses significantly lack curricular cohesion throughout the United States. The topics covered in secondary methods courses vary significantly from one university to the next. Our research study identifies similarly valued topics of secondary methods courses by surveying instructors of secondary methods courses to identify what topics, referred here as “touchstones”, are valuable to the field. In this study 116 secondary mathematics methods instructors from different American universities completed a survey describing how 41 pre-selected, research-based touchstones were valued within their curriculum. Results include identifying which touchstones were valued the greatest and the least. The results also include looking at variance between department of instruction (mathematics versus education) and level of professorship (i.e. assistant, associate, full). Participants will analyze the results, create extensions for future research, and discuss implications for STEM education to build partnerships across the country.

Student Success and Retention through Transformation of Lower Division STEM Critical Courses**Time:** Wednesday, June 3, 2015, at 11:10 AM - 11:40 AM**Location:** Bienville**Authors:** Suzanna Rose, Florida International University; Leanne Wells, Florida International University

Abstract: In response to new statewide performance metrics for institutional funding, Florida International University identified, and targeted for transformation, courses critical to student retention and graduation. Using key elements of the highly successful Mastery Math Program as a model, FIU has replaced adjuncts with instructors, formed course-specific weekly working groups, implemented high-touch early alerts, integrated appropriate technology for teaching and formative assessment, and required adoption of in-class active learning with the use of undergraduate Learning Assistants. We share the Mastery Math structure, mechanisms for implementation, and discuss keys to leveraging existing programs for large scale transformation. Results include increased passing rates in College Algebra by over 30%, in Intermediate Algebra by over 25% and in Finite Math by over 20%. Mastery versions of online courses have increased pass rates by as much as 55%. We also report Chemistry, Trigonometry, and Precalculus Algebra early results from Spring 2015 implementation.

Evidence-Based Research Experiences for Undergraduates: Using Assessment and Evaluation to Build Effective Research Experiences for Multiple Purposes**Time:** Wednesday, June 3, 2015, at 11:10 AM - 11:40 AM**Location:** Iberville**Authors:** Wilella D. Burgess, James Lehman, Loran Carleton, Parker, Ann Bessenbacher, Lisa Kirkham, and Amy Childress, Purdue University

Abstract: Although a variety of benefits to research experiences for undergraduates (REUs) are commonly accepted, rigorous research to validate these benefits across programs is limited. Over the past 15 years, the Discovery Learning Research Center has been involved in designing and assessing a wide array of laboratory-based REU programs with very different purposes. While each of these REU programs has a structure and evaluation plan that is specific to the program goals, we have developed

common assessment tools that allow us to pool data and to make comparisons across programs. This strategy allows us to better understand the strengths and weaknesses of each program design and gain a better understanding of the promise and limitations of REU programs both generally and for specific audiences. The proposed talk will describe the various REU programs, development of common assessment and evaluation strategies, and present representative data illustrating lessons learned through this approach.

[Collaborating Across Colleges and Institutions to Improve Secondary STEM Teacher Preparation](#)

Time: Thursday, June 4, 2015, at 9:30 AM - 10:00 AM

Location: Bienville

Authors: Michael DeGraff, UTeach Institute at The University of Texas at Austin; Steven Case, University of Kansas

Abstract: The UTeach Institute, established in 2006, supports the development of secondary STEM teacher preparation pathways modeled on the UTeach program, which started at The University of Texas at Austin in 1997. In this session will discuss how we engage the UTeach network of instructors to ensure the implementation of a high quality program. The focus will be on training and supporting faculty across the 44 UTeach partner programs in relation to the sequence of nine UTeach model courses.

[Comprehensive Assessment to Examine Impacts of a Disciplinary Teaching and Learning Center on Undergraduate Education](#)

Time: Thursday, June 4, 2015, at 9:30 AM - 10:00 AM

Location: Iberville

Authors: Gili Marbach-Ad, University of Maryland

Abstract: This study researched the utility of a university Teaching and Learning Center (TLC) based within a disciplinary unit and focused on teaching within the interrelated disciplines of chemistry and biology. There is a growing recognition that teaching expertise is necessary to ensure that students develop a deep, lasting understanding. As a result, higher education institutions have increasingly emphasized teaching professional development to help university faculty members compensate for their lack of specific training in teaching. To adapt the mission of the center to the departments we serve, we first conducted a multi-faceted needs assessment, followed by comprehensive, ongoing research assessment. Using five levels of evaluation (Participation, Satisfaction, Learning, Application, and Impact), we investigated not only the extent to which faculty in our affiliated departments adopted recommended pedagogies, but also the degree of student satisfaction with these changes. This comprehensive evaluation can serve as a model for other professional development programs.

[STEM Education Center Network](#)

Time: Thursday, June 4, 2015, at 9:30 AM - 10:00 AM

Location: Queen Anne Parlor

Authors: Noah Finkelstein, University of Colorado at Boulder; Kacy Redd, APLU

Abstract: If you are a new STEM Education Center and would like to learn more about the past activities and future directions of the STEM Education Center Network, please join us.

Using Complexity Leadership Theory to Plan for Emergent Change**Time:** Thursday, June 4, 2015, at 10:05 AM - 10:35 AM**Location:** Bonnet Carre Room**Authors:** Charles Henderson, Western Michigan University; Andrea Beach, Western Michigan University

Abstract: There is a large and growing community interested in creating department- or institution-level change in undergraduate STEM education. Many of these change initiatives involve faculty working together in teams. Unfortunately, the current research on these team-based approaches is scant and provides little guidance for developing and sustaining team-based change efforts. Complexity Leadership Theory (CLT) offers a framework to identify important characteristics of team-based change approaches. Although this perspective has not been widely applied in higher education, it has been used as the lens to study change and organizational learning in K-12 schools, churches, and businesses. This session is designed to introduce participants to the core ideas of CLT and, using examples from our own work and research, discuss how the framework can be used to plan change initiatives that engage faculty in collaborative work with emergent outcomes.

The Learning Assistant Model: Supporting Student Success through Course Transformation**Time:** Thursday, June 4, 2015, at 10:05 AM - 10:35 AM**Location:** Queen Anne Parlor**Authors:** Robert Talbot, University of Colorado Denver; Laurel Hartley, University of Colorado Denver

Abstract: Use of the Learning Assistant (LA) model in undergraduate math, science, and engineering courses leads to: 1) improved student learning, 2) sustained course reform efforts within departments, 3) engagement of faculty and administrators, and 4) recruitment of high performing math, science, and engineering majors into secondary teaching careers. LAs are undergraduate students who have been successful in their courses and are recruited by faculty to apply to the program (selection is competitive). LAs support course transformation by facilitating student-centered methods of teaching and learning (e.g., small group discourse in class, peer tutoring). LAs receive support through weekly meetings with faculty and by participating in a course on math and science teaching. In addition to improved student learning, research by some institutions within the 80-member Learning Assistant Alliance show fewer student drops, higher graduation rates for students who serve as LAs, and evidence of highly connected, interactive learning environments.

Roundtables

[Engaging STEM Faculty Through Collaborative Teaching Experiences with Education Specialists](#)

Authors: Denise Bressler, Arthur Camins, and Rainer Martini, Stevens Institute of Technology

Abstract: The Scholars program at Stevens Institute of Technology offers in-service teachers five graduate courses in science and engineering over two years. Initially, courses were to be taught by Stevens' disciplinary faculty. As the program evolved, it became clear that meeting the needs of in-service teachers required augmenting the professor's content expertise with the pedagogical, assessment, and school-based expertise of educational specialists. In the new model, courses are co-led. Project findings suggest that in-service teachers are deepening their science content knowledge and the disciplinary faculty are deepening their understanding of effective teaching practices. This panel presentation will delve into the collaborative effort among the disciplinary faculty and educational specialists who develop and co-lead Scholars courses. Panelists will share their thoughts about what they learned from the collaboration, with specific focus on how the collaborative relationship evolved and what each person learned during the co-teaching experience.

[Implementing a Networked Improvement Community for Learning Math in Middle Grades](#)

Authors: Larry Flick, Oregon State University

Abstract: A school – university – community college partnership in Oregon turns its 10-years of experience to improving proficiency in math as a pivotal subject supporting high school completion and transition to post-secondary education. The Partnership will launch a networked improvement community as part of the Carnegie Foundation Design Learning Lab project to scale up implementation across as many as four school districts, two community colleges, and introductory university mathematics. Viewing math performance a community problem, the project will address community wide attitudes toward and value of math, teaching practices, and perceived relationship of math to the workplace and everyday life. The presentation will include (a) a brief sketch of networked improvement community (NIC) concepts and tools applied to Partnership work, (b) description of our team's learning and planning for launching a NIC initially focused on the middle grades, and (c) responses from Partnership leadership.

[The Vermont STEM Collaborative](#)

Authors: Regina Toolin, University of Vermont; Donna Rizzo, University of Vermont; John Hanning, Archimedes Aerospace LLC;

Abstract: The Vermont STEM Collaborative (VSTEM) comprises a network of over 60 professionals that include formal and informal STEM educators, school administrators, state agency representatives, university faculty and STEM businesses partners from Vermont. In this presentation, 3 panelists from across STEM fields and businesses will discuss the organization and structure of the VSTEM Collaborative with a focus on recent initiatives established by the collaborative. Of particular interest will be a presentation of the VSTEM website that includes the STEM Commons or online portal of STEM education resources that can be utilized for a variety of educational purposes.

[Leveraging STEM Initiatives to Promote Active Student Engagement Across Campus](#)

Authors: William Martin, North Dakota State University; Paul Kelter, North Dakota State University

Abstract: Since 1995, NDSU has had multiple successful efforts to strengthen STEM education involving school teachers, education and STEM discipline faculty. Our Center for Science and Mathematics Education more recently established a STEM Education PhD program with new, discipline-based educational research faculty positions. Now a new STEM classroom building will open in January 2016. These programs and state of the art instructional labs and classrooms are being leveraged to promote active student engaged instruction across campus. Our administration supported faculty teams to establish ongoing, intensive and collaborative professional development to ensure that the instructional facilities are utilized for their designed purpose. This session will focus on how we will use the new resources to promote student centered instruction in and beyond our STEM disciplines.

[Engaging Faculty through a Rapidly Growing LA Program](#)

Authors: Jacqueline Bortiatynski, Danny Sykes, Jennelle Malcos, Richard Cyr, Meredith Defelice, Wendy Hanna-Rose, Eric Hudson, and Stephen Van Hook, Pennsylvania State University University Park

Abstract: The major barriers to engage faculty in research based teaching methods at large R1 institutions are fairly well known: large class sizes, broad student demographic, lack of time for curricular reform, and inadequate exposure to the learning sciences. Penn State has a fast growing Learning Assistant Program that has engaged approximately 500 student facilitators since the Fall of 2011. These ambassadors for learning are catalyzing the engagement of faculty and have become an integral part of our instructional teams especially in entry-level courses that range in size from 300- 500 students. In this presentation, we will share information relating to the growth of faculty engagement in active learning activities as a function of LA program growth. We will also provide information in regard the ways faculty are utilizing and mentoring LAs as well as how the new instructional teams are working together to improve student motivation, learning, and retention.

[The Montana Science Olympiad: Connecting the University with Middle and High Schools across the Big Sky State](#)

Authors: Mary J. Leonard, Montana State University; Elena Kalinina-Turner, Montana State University

Abstract: In 2014, the Science Math Resource Center at Montana State University (MSU) hosted its 30th Montana Science Olympiad as part of the National Science Olympiad program, attracting 1000 students from 40 middle schools and 41 high schools across the state. Hosting the Olympiad at MSU reflects a partnership between the university and participating schools. To further develop this partnership, 100 event captains and volunteers from across MSU and the community prepared and ran competition events, hosted tours of labs and centers, and presented their programs or research. Furthermore, MSU programs and colleges “bought into” the Olympiad as sponsors, contributing \$10,000 toward its operation. We sought to broaden participation of under-represented (rural) Montana communities by giving awards to the top three scoring middle and high school teams from small schools, and presenting

the winning middle and high school teams with checks to help fund their trip to the National Science Olympiad.

[The Impact of Undergraduate Research Experiences in Education](#)

Authors: Denise Earley, Lynn Reimer, Kevin S. Reimer, and Whitney Young, University of California-Irvine

Abstract: Providing students with undergraduate research experiences is believed to enhance their academic experience and provide opportunity for skill development and mentorship. The University of California, Irvine, has a strong commitment to supporting undergraduate research opportunities through various programs on campus. These include specific courses on research methods and statistics, the Undergraduate Research Opportunity Program (UROP), the Summer Undergraduate Research Program (SURP), and a spring symposium where students present research findings. Additionally, students enroll in research units to work on a project with faculty, post-doctoral students, and graduate students. We surveyed all undergraduates in the School of Education about their research experiences. We use multiple regression to measure several potential student outcomes: (1) improved oral and written communication, (2) enhanced critical thinking and problem solving; (3) improved technology skills; and (4) improved self-regulated learning. Together these data provide successful models for incorporating research experience for students, including pre-service teachers.

[The Office of STEM Education at the University of Georgia Supporting the University/K-12/Local Community Nexus](#)

Authors: Charles Kutal and Kris Biesinger, University of Georgia

Abstract: The Office of STEM Education (OSE) at the University of Georgia provides campus-wide leadership and support for activities that improve STEM teaching and student learning. It also facilitates partnerships among members of the university, K-12, and local communities. Successful OSE-supported activities include: (1) a mini-grant program designed to encourage STEM faculty to undertake innovative projects that improve undergraduate instruction, (2) learning communities of university faculty and K-12 teachers who work together to develop and share professional knowledge, (3) the annual STEM Institute on Teaching and Learning that provides a forum for sharing best practices in STEM teaching and catalyzes the formation of new partnerships among diverse groups, and (4) FOCUS (Fostering Our Community's Understanding of Science), which is a service-learning program that partners university students, majoring in a science-related discipline, with elementary and middle school teachers in the local school district to help teach science to children in grades K-8.

[SPARCT: A Faculty Development Program Focusing on Introductory STEM Courses](#)

Authors: Laura Frost, Florida Gulf Coast University

Abstract: Florida Gulf Coast University has begun a STEM faculty professional development program called STEM Professional Academy to Reinvigorate the Culture of Teaching (SPARCT) to affect student retention and recruitment in introductory STEM courses. SPARCT includes a 36-hour summer STEM academy immersion experience focused on evidence-based practices, peer-peer observations, and a

year-long commitment on the part of the participants to study student learning in their classrooms. One year of SPARCT has been completed. We chronicled faculty development progress through video interviews with participants, student retention, interest, and confidence in SPARCT participant classes, and faculty feedback on programming. Qualitative data and results collected from the videos, quantitative data from the student surveys and faculty feedback will be discussed. Advice and lessons learned for others interested in developing a similar program will also be discussed.

Change at the Core: Transforming Introductory STEM Courses at Three Institutions

Authors: Emily Borda, Western Washington University; Daniel Hanley, Western Washington University

Abstract: "Change at the Core" (C-Core) is a multi-disciplinary project working to transform undergraduate STEM education at one university and two 2-year colleges. C-Core's primary goal is to improve student engagement, learning, and success in STEM by creating a critical mass of STEM faculty who understand and regularly use evidence-based teaching and learning practices. The C-Core professional development model includes week-long summer institutes, quarterly Saturday workshops, and regular meetings of disciplinary Professional Learning Communities (PLCs). These activities support inter-institutional faculty teams in deepening their understanding of cognition and practicing student-centered teaching and learning strategies. Data from case study participants have revealed a wide variety of practices adopted, together with positive student impacts. Barriers toward adoption of evidence-based practices have also been documented, both by faculty and students. We will share the successes of our program, as well as lead a discussion about how to mitigate barriers toward adoption of evidence-based practices.

Partnership beyond the University: Collaboration for Authentic STEM

Authors: Robert Mayes, Georgia Southern University

Abstract: The Institute for Interdisciplinary STEM Education (i2STEMe) at Georgia Southern University has developed collaborative partnerships with K-12 school districts, research institutes, business/industry, military bases, informal science organizations, the University System of Georgia, and the Georgia Department of Education. The objective of the collaborations is to develop authentic STEM research and engineering design opportunities for students. Opportunities that will increase the STEM pipeline by broadening participation of underrepresented groups in STEM, including minority, women, low SES, and rural student populations. Opportunities that will re-engage students so they can become STEM literate citizens capable of making data-informed decisions about grand challenges facing their generation. The student learning objective is to develop 21st century interdisciplinary STEM reasoning modalities, including complex systems reasoning, scientific model-based reasoning, computational reasoning, engineering design reasoning, and quantitative reasoning. In this presentation we will discuss two programs developed through these partnerships: Real STEM and STEM Fest.

Moving a STEM Center from Grant-funded Program to Institutional Resource

Authors: Donna Llewellyn, Boise State University

Abstract: Many STEM Centers start out being fully (or close to fully) funded through external grants. This Roundtable Discussion will be about the transition to being a true institutional resource with a line item budget. This can take several forms – from carving out part of the Center’s mission to have an internal focus on your home campus to becoming fully funded by your university. We will talk about how to engage the upper administration and faculty to gain support – both financial and general backing for your work. Further topics of discussion will include some of the challenges (besides financial) of serving multiple stakeholders, setting appropriate expectations, and defining the scope of a STEM Center when those issues are no longer completely defined by funding agencies and proposal documents.

Posters

[Mathematician and Mathematics Educator Co-teaching in a Methods Course: Synthesis of a Three-year Study](#)

Authors: Pier A. Junor Clarke, Georgia State University; Nermin Bayazit, Georgia State University

Abstract: In our initial teacher preparation (ITP) program for pre-service secondary mathematics teachers (PSSM), each year two mathematics educators from the College of Education and one mathematician from the College of Arts and Sciences collaborated to design, develop, and co-teach a module of Statistics in a mathematics methods course after piloting the study within a summer methods course in 2012. We facilitated and modeled the development of lesson plans for the Common Core State Standards for Mathematics (CCSS-M) focusing on a module of Statistics, while embracing mathematical practices and reflecting on the previous implementations. In this presentation, we will share our experiences of co-teaching over the past three years and discuss the lessons learned to implement an effective co-teaching model.

[Resources For Higher Education: A New Web Portal for Institutions, Programs and Faculty Members in STEM Fields and Beyond](#)

Authors: Cailin Huyck Orr and Cathryn A. Manduca, Science Education Resource Center at Carleton College

Abstract: Significant and far reaching progress has been made in the last two decades on improving pedagogy, and the associated opportunities for professional development. However, resources resulting from these innovations are dispersed across projects and institutions, and can be hard to locate. To address this issue, the Science Education Resource (SERC) has a new web portal aimed at institutions, programs and faculty members from across STEM disciplines and allied fields. The focus is to bring together resources for : improving teaching and learning, designing and implementing new courses and programs, planning career pathways for professionals, supporting students beyond the classroom and into the future, as well as resources by discipline. This portal directs users to materials designed by 2,900 participants from more than 1,000 different institutions of higher education, to support educators, disseminate new information and engage the community.

[Reaching Students where They Are: Our On-Line Introduction to Astronomy Course at UCI](#)

Authors: Tammy Smecker-Hane, University of California, Irvine

Abstract: We report on our experience in creating and delivering a fully on-line Introduction to Astronomy course at the University of California, Irvine (UCI). It is open to students at all ten University of California campuses as well as non-UC students, and is a popular way to satisfying the university's science breath requirements. Our on-line course is nearly identical to the traditional lecture course. Students use the same textbook, do the same homework, quizzes and exams, but they watch on-line lectures taped from previous years of the traditional lecture course. In this poster, we discuss the course content, report on the student demographics, motivations for taking the on-line course and student evaluations, compare student outcomes, and share some very valuable lessons learned. In

short, our experience has been extremely positive for both instructors and students, and it has significantly expanded the population of students who take introductory astronomy.

Establishing an Undergraduate Science & Math Pipeline: Enhancing K-12 Teaching and Building Connections to Higher Education

Authors: Jordan Gerton, Holly Godsey, Tino Nyawelo, Emily Gaines, and Erin Moulding, Nadia Jassim, and Joan Randazzo, University of Utah

Abstract: The University of Utah's Center for Science and Mathematics Education (CSME) is establishing a pipeline to promote undergraduate student success in math and science. Through a combination of well-established and pilot programs, the CSME addresses multiple areas of the pipeline by enhancing K-12 math and science teaching, providing a support structure for students as they transition to the University, and offering programs to promote undergraduate retention and success, including for minority and New American populations. Specifically, CSME programs include K-12 teacher preparation and professional development, school district partnerships, K-12 classroom and afterschool enrichment, bridge programs for students entering the University, analysis of undergraduate student performance data, professional development for teaching assistants, and unique team-based experiences for science undergraduate students.

Exploring the Alignment Between Postsecondary Education and Workforce Needs: The Central Role of Active Learning in Cultivating Non-cognitive Skills in Students and Workers

Authors: Matthew T. Hora, Amanda K. Oleson, and Ross J. Benbow, University of Wisconsin - Madison

Abstract: In the context of debates about the misalignment between education and workforce needs, this ethnographic field study examines these dynamics in Wisconsin. Results highlight the importance of technical skills as well as non-cognitive skills (e.g., communication, work ethic), and how educators and employers cultivate and reward these competencies through teaching, training, and hiring practices. In particular, I highlight the role that active learning can play in cultivating both skillsets, thereby meeting the needs of both the labor market as well as education experts. The critical role that cross-sector partnerships play in facilitating cross-sector communications and student transitions from school-to-work are also discussed. A new diagnostic model for conceptualizing education and industry alignment using Bourdieu's social field theory is introduced with implications for public policy and postsecondary education's role in the 21st century economy.

Are STEM Faculty Engaged in Data Driven Decision-making? Reports from a Field Study on Continuous Improvement Systems for Instructional Improvement

Authors: Matthew T. Hora, University of Wisconsin – Madison; Jana Bouwma-Gearhart, Oregon State University; and Hyoung Joon Park, University of Wisconsin – Madison

Abstract: Data driven decision-making is a central feature of educational reform, yet little is known about how STEM faculty use data when making decisions about curriculum design and classroom teaching. In this study we report findings from interviews with 56 faculty, finding that faculty draw upon a variety of numeric data and other types of information in their work. These data practices can be characterized by the type of analysis, goals for data use, reliance on data experts, and existence of

continuous improvement systems. Exploratory data reduction analysis identified five distinct types of data practices which highlights the fact that no single type of data use exists, but that faculty draw upon different data and analytic procedures depending on the situation. Results highlight the importance of high-quality data and social networks related to data use, and that the rush towards “big data” and analytics should be tempered by the fact that in practice many faculty who exhibit robust data driven decision making behaviors also utilize “small data” and rely on their expertise and intuition.

[Integrative STEM Education: A Catalyst for Transdisciplinary Collaboration at the University of North Dakota](#)

Authors: Robert Pawloski, University of North Dakota

Abstract: University of North Dakota College of Education has placed Integrative STEM Education as a high priority. In the past academic year (2014-15) UND hired a STEM Coordinator and formed an interdisciplinary Work Group with representatives across Colleges and Departments. Broad goals identified by the Work Group include:

- Facilitate communication about professional development, collaborative funding and connections across UND as well as industry, community and state regarding STEM Education.
- Develop a coherent entry point for K12 schools, industry, state and community to interact with STEM experts and programs at UND.
- Identify existing STEM Education research at UND and encourage further studies, and identify national trends in STEM Education
- Complete a strategic planning document based on data, scientific frameworks, and UND context and culture that will result in a UND mission statement for STEM Education.
- UND looks forward to exchanging experiences and reflections with other institutions going through similar processes.

Interdisciplinary Curriculum and Strategic Partnerships to Increase Interest in and Access to STEM**Time:** Wednesday, June 3, 2015, at 9:30 AM - 10:00 AM**Location:** Iberville**Authors:** Cathy Manduca and Cailin Huyck Orr, Science Education Resource Center at Carleton College

Abstract: Broadening access to STEM disciplines in higher education is a wicked problem that requires innovative solutions and a variety of approaches. One approach that has shown success in engaging students who have not previously pursued STEM fields, is capitalizing on interest in environmental resources issues and use this interest to encourage students to study earth systems. InTeGrate, a 5-year, NSF-funded STEP Center supports and funds development of interdisciplinary, sustainability curriculum, and programs to implement this. In this talk we will highlight three of these implementation programs from large universities which harness enthusiasm of students surrounding environmental problem solving, with programmatic changes, to engage students from diverse backgrounds. Examples highlight how curricular changes, supporting students in and out of their classroom, and strategic partnerships between 2-year and 4-year institutions can broaden interest in and access to STEM disciplines. They also highlight the impact a small, well-coordinated team, can have at their institution.

Making the Case to Build Inclusive Classrooms that Drive Student Success**Time:** Wednesday, June 3, 2015, at 9:30 AM - 10:00 AM**Location:** Bonnet Carre Room**Authors:** Erin Sanders, University of California Los Angeles

Abstract: UCLA is committed to improving student academic success, reducing time to degree, and increasing the graduates rates of all undergraduates. To better understand how instruction is delivered to our students, we are combining survey research with institutional data to examine diverse classroom environments campus-wide and engaging faculty and departments in a self-assessment of teaching practices. This information will enable us to identify best practices as well as understand the institutional and cultural barriers keeping departments entrenched in outdated pedagogy and curricular models. These data-driven insights should provide the leverage needed to catalyze a shift away from instructional practices adversely affecting classroom diversity, student learning outcomes, and attrition rates in STEM. We also will highlight how a Center for Education Innovation focused on STEM instruction in the Life Sciences is advancing this initiative through the compilation of teaching and assessment resources and by supporting the professional development of STEM faculty.

The MTE-Partnership: A National Network to Transform Secondary Mathematics Teacher Preparation**Time:** Wednesday, June 3, 2015, at 10:10 AM - 10:40 AM**Location:** Bonnet Carre Room**Authors:** W. Gary Martin, Auburn University; Margaret Schroeder, University of Kentucky; Marilyn Strutchens, Auburn University

Abstract: The Mathematics Teacher Education Partnership (MTE-Partnership) was formed by APLU's Science and Mathematics Teacher Imperative to address the challenge of increasing the supply of new secondary mathematics teachers who are prepared to help their students meet the rigors of the Common Core State Standards and other college and career ready standards. This collaboration of

school-university partnerships includes 89 universities, 9 community colleges, and over 100 school districts from across 30 states, working to transform secondary mathematics teacher preparation using the networked improvement community (NIC) model designed by the Carnegie Foundation. A series of research action clusters has been formed to address central challenges in secondary mathematics teacher preparation, including improving clinical experiences, enhancing candidates' content knowledge for teaching, and addressing recruitment of candidates into secondary mathematics. This session will include an overview of the partnership and its methodology, as well as highlights of its on-going research.

Evaluating Impacts of STEM Centers: Beyond Metrics**Time:** Wednesday, June 3, 2015, at 10:10 AM - 10:40 AM**Location:** Bienville**Authors:** Matt Feldmann, Goshen Education Consulting, Inc.; Sharon Locke, Southern Illinois University Edwardsville

Abstract: Evaluation data are critical for communicating STEM center impacts to stakeholders, ensuring progress towards strategic goals, and securing administrative support. While simple metrics such as numbers of people served can be compelling, a strong evaluation strategy uses multiple lines of evidence to build a case for the value of a STEM center to its university and the broader community. This session will demonstrate how a social network analysis (SNA) was used to study the relationships that a STEM Center faculty and staff developed within a university community and with external organizations, an activity that is central to the center's core mission and strategic goal to build and maintain partnerships. Session participants will discuss possible applications of SNA to their center, as well as contribute ideas for other successful and promising approaches to evaluation of STEM centers.

Design-Based Implementation Research to Study and Drive an Undergraduate STEM Education Improvement Project at Oregon State**Time:** Wednesday, June 3, 2015, at 10:10 AM - 10:40 AM**Location:** Queen Anne Parlor**Authors:** Jana Bouwma-Gearhart, Kathleen Quardokus Fisher, Ann Sitomer, David Little, John Ivanovitch, Christina Smith, and Milo Koretsky, Oregon State University

Abstract: We share experience implementing a project to increase evidence-based instructional practices in large, intro-level STEM courses via inter-and intra-disciplinary communities of practice, targeted synergy with other STEM improvement entities (including a new STEM Center), and modification of pertinent organizational structures. We discuss research attempting to document and study the associated change, including at individual, departmental, and institutional levels. We detail our project's theory of action within a design-based implementation research framework, fostering continuous project improvement via feeding data back into the organizations of focus. We describe our larger research plan, a careful and deliberate meld of various theoretical frameworks and methodologies, allowing us to study the phenomena of interest in robust ways. We lead a discussion among participants regarding the affordances and problems of organizational change research design and potential collaboration concerning more meaningful exploration of initiative impacts, such as those detailed in the categories described in SMTI's conference call.

WORKSHOP: Broadening University Research to K-12 Outreach: Lessons Learned and Practical Resources for All**Time:** Thursday, June 4, 2015, at 9:30 AM - 10:35 AM**Location:** Queen Anne Ballroom**Authors:** Cassandra Horii, James Maloney, and Julius Su, California Institute of Technology

Abstract: Fully half of the staff at Caltech's Center for Teaching, Learning, and Outreach are dedicated to linking university activities to the broader (K-12) community. Our STEM Education Center uses collaborative learning technology and do-it-yourself instrumentation to effectively scale efforts to translate university level research into learning units for teachers and students. In our highly interactive workshop, participants discuss outreach practices and our replicable program models and experience, first-hand, technologies for improving student engagement at both K-12 and undergraduate levels, and enabling large-scale scientific discovery and collaboration between universities, schools, and other organizations. We discuss creating student and teacher education programs with openly-shared materials, and holding public events where teachers are inspired and empowered by university research and demonstrations to create lessons together. Participants will leave with resources and documentation useful for implementing or extending outreach programs at their site.

Developing an Integrated STEM Teacher Education Certificate Program: Opportunities and Challenges**Time:** Thursday, June 4, 2015, at 9:30 AM - 10:00 AM**Location:** Bonnet Carre Room**Authors:** Lynn Bryan, Purdue University

Abstract: The Center for Advancing the Teaching and Learning of STEM (CATALYST) at Purdue University is leading a collaborative effort across five colleges (Colleges of Education, Engineering, Science, Technology, and Agriculture) to design and implement a new degree certificate program in K---12 integrated STEM teaching. This session will address how Purdue is shaping learning outcomes for both elementary and secondary STEM education majors, as well as training and evaluating faculty teaching in the STEM integration teacher education certificate program. In this session, we will articulate the guiding conceptual framework and learning goals of the program; share our model of faculty professional development and teacher preparation; present evaluation data from piloted components of the program; and discuss opportunities and challenges encountered in cross---college collaboration and program development.

Helping Teachers and their Coaches Survive and Thrive: University of Florida's Online STEM Teacher Induction & Professional Support (STEM TIPS) Project**Time:** Thursday, June 4, 2015, at 10:05 AM - 10:35 AM**Location:** Iberville**Authors:** Emma Brady, Thomas Dana, and Griffith Jones, University of Florida

Abstract: Discover the University of Florida's STEM TIPS Initiative to provide a collaborative online mentoring and professional development system to boost retention and accelerate the professional growth of STEM teachers while building the capacity and expertise of instructional coaches. Teachers and their instructional coaches use a mobile-ready platform to access multiple tiers of support – from engaging in a community of practice to receiving feedback from online coaches and colleagues,

accessing classroom-tested resources to utilizing remote video coaching technology for specific assistance in developing instructional coaching strategies to effectively promote engaging standards-aligned lessons or implement classroom management strategies. Field-tested by 3 universities and 15 school districts supporting over 1000 teachers, with 100% school principal satisfaction and 85% of teachers reporting it improved their teaching, the STEM TIPS system allows programs to extend a lifeline to teachers. In addition to discussing the pilot study results, we will demonstrate recent platform innovations.

STEMS2: Building Partnerships to Support Broad Participation in P-20 STEM Education

Time: Thursday, June 4, 2015, at 10:05 AM - 10:35 AM

Location: Bienville

Authors: Tara O'Neill, University of Hawaii at Manoa; Joseph Zilliox, University of Hawaii at Manoa

Abstract: Presenters will elaborate on the creation and implementation of the STEMS2 program to develop teacher leaders capable of bringing the goals of STEMS Education to P-20 learners. This will include details on the process involved in building an interdisciplinary advisory group, and mechanisms and efforts to open participation to a broad statewide audience. Presenters will engage with the audience to learn of their experiences and challenges in similar endeavors. The STEMS2 project involves the collaboration and contributions of University and Community College faculty, k-12 classroom teachers, and community leaders expert in cultural knowledge and traditions. Program participants were recruited and accepted from diverse backgrounds, educational experiences and geographic areas. During the first year of the project, the participants explore the complex relationship between human beings and their natural, social and built environments via multiple experiential learning experiences called "Learning Journeys".

Roundtable 1. Building Community Partnerships: A Roundtable Discussion with North Carolina's University STEM Center Directors

Authors: Chris Gordon, University of North Carolina at Wilmington; Phillip E. Johnson, Appalachian State University; Dennis Kubasko, University of North Carolina Wilmington; Shawn A. Moore, East Carolina University; Jason Painter, North Carolina State University; David Pugalee, University of North Carolina at Charlotte; Scott Ragan, North Carolina State University; Vincent T. Snipes, Winston Salem State University; Alisa Wickliff, University of North Carolina at Charlotte

Abstract: Six active university STEM Centers from across the state of North Carolina have partnered together to explore a comprehensive STEM Education Network. Please attend a roundtable presentation and actively engage with North Carolina's university STEM Center directors and assistant directors as we discuss both established and emerging community partnerships that successfully serve both teachers and students across the state of North Carolina. We will also provide updates on support efforts to improve teaching and learning in the STEM disciplines from across our service regions and state. Information on successful engagement strategies such as Technology Loan Programs, teacher professional development offerings and K-12 STEM student efforts will be addressed. This roundtable will be an interactive conversation between presenters and participants. Come prepared to hear about best practices and share your Center's best practices.

Roundtable 2. Collaborative Around Research Experience for Teachers (CARET) — Shared Metrics for Researching Outcomes of Research Experiences for Pre-Service and In-Service Teachers

Authors: Charles Coble, The Third Mile Group; Benedikt Harrer, University of California, Berkeley; Bruce Johnson, University of Arizona; John Keller, California Polytechnic State University-San Luis Obispo; Renee Schwartz, Georgia State University

Abstract: Through support from the 100Kin10 Initiative, representatives from six teacher-researcher programs serving both pre-service and in-service educators are collaborating to share program goals, curricula, implementation, and most importantly ways that these programs are evaluated. This collaborative effort, spawned during a lunch conversation during the 2013 APLU SMTI Meeting in St. Louis, currently involves three SMTI institutions engaging undergraduates in authentic research experiences and two SMTI institutions focused on in-service teacher researcher experiences. Four of these programs involve strong partnerships beyond the university. During this panel presentation, we will discuss both individual and shared evaluation tools and outcomes and explore opportunities for other STEM Centers to join the Collaborative Around Research Experiences for Teachers (CARET).

Roundtable 4. Working in Concert: Four-Year and Two-Year Institutions Driving STEM Student Success

Authors: Dabney Dixon, Georgia State University; Cynthia Y. Lester, Georgia Perimeter College

Abstract: This Roundtable will focus on strategies to help students from two-year institutions transition smoothly to four-year institutions. Successful (and not-so-successful) strategies to reduce transfer shock and mitigate the disjunction that accompanies the transfer process will be shared. The conveners are from Georgia State University (GSU) and Georgia Perimeter College (GPC), which have been long-standing educational partners with a common goal of creating graduates that will thrive in the global society. On average each year GSU accepts approximately 1500 transfer students from GPC. The GSU Center for STEM Education Initiatives and the GPC Office of STEM Initiatives work in concert to expand opportunities for students by providing support and co-curricular programs; promote innovations in teaching approaches and practices; and deepen student and faculty engagement with the purpose of developing and supporting exemplary practices and policies in STEM education.

Roundtable 7. Bringing out the E in STEM Education: Forging Successful Partnerships between Colleges of Education and Engineering and the Local School Districts

Authors: Margaret Schroeder, University of Kentucky; Craig Schroeder, Fayette County Public Schools; Bruce Walcott, University of Kentucky

Abstract: Given the current focus of many grants and others' required attention to broader impacts concerning society at large, the current reality for many postsecondary faculty is that if they wish to compete for federal funding in the current economic climate they need to demonstrate involvement in K-20 STEM education improvement endeavors. The University of Kentucky's Colleges of Education and Engineering began collaborating on grants and research in 2007 and have been successful in forging a unique relationship that has brought about many opportunities for preservice and inservice STEM teachers, engineering undergraduate and graduate students, and had a broad impact on the K-12

students of the Commonwealth of Kentucky. This session will share how these partnerships came about and share data, results, and examples from grant-funded projects that have focused on broader impacts.

Roundtable 8. Biosciences Retention and Academic Innovation Network for Students (BRAINS)

Authors: Melinda Hamilton, University of Idaho; Patricia Hartzell, University of Idaho

Abstract: Biosciences Retention and Academic Innovation Network for Students (BRAINS) takes a collaborative, problem-solving approach to train undergraduates in relevant research while addressing fundamental biological, chemical, and ecological questions. Studies show that retention of students in STEM disciplines increases when they have the opportunity to engage in research that they find relevant and meaningful (Lopatto, 2010). The goals of this program are to increase student achievement and understanding of fundamental science concepts, stimulate critical thinking, introduce students to authentic research and ultimately to increase student retention in STEM disciplines. In this session, we will present examples of freshman and sophomore lab modules that incorporate research questions into laboratory experiences that teach and reinforce fundamental laboratory methods and content while integrating these key disciplines. Additionally, we will present assessments being developed to determine both the students' understanding of the concepts covered as well as student interest and potential to continue in a STEM discipline.

Roundtable 10. Community is the Key: Retention of STEM Majors in a Preservice Teacher Program

Authors: Theresa Hopkins, University of Tennessee; Molly Schaeffer, Gresham Middle School

Abstract: VolsTeach, at the University of Tennessee, is one of the replication sites of the successful UTeach program at the University of Texas, Austin to prepare future STEM teachers. The program seeks to engage the interest of STEM majors to consider teaching as a career. Critical factors to attract students include casting a wide net with a 1-hour introductory course, early field experiences, and internship opportunities. With high budget demands in their major field, an additional 24-27 hour minor increases pressure on students which can inhibit retention of students in the program. VolsTeach has worked to develop a sense of community in which students feel they belong. Picnics, game night, chili cook-offs, and a student organization are some of the ways VolsTeach builds a sense of belonging. This roundtable discussion will share the experiences of a Master Teacher in the program as well as two graduates of the program.

Roundtable 11. Ensuring Preservice Secondary Teachers Are Prepared for State Certification Exams

Authors: Ruthmae Sears, University of South Florida

Abstract: To ensure our preservice teachers continued success on the state certification, with the enhanced requirements, The University of South Florida adopted the use of MyMathTest to assess and remediate, if needed, our preservice teachers mathematics content knowledge. MyMathTest can be used as a refresher course to enhance mathematical understanding because preservice teachers can take a test and have a personalized study plan to remediate areas of weakness. MyMathTest is aligned with Florida's grade 6-12 mathematics competency and skills for teachers. The test consists of 29

questions, and assesses preservice teachers' knowledge of algebra, functions, geometry, trigonometry, statistics and probability, calculus, and mathematics reasoning. During this presentation, we will discuss preservice teachers' performance on the MyMathTest, and their perceptions about MyMathTest.

Roundtable 12. Research Experiences for Teachers: Elements of Success and Models of Transferability

Authors: Holly Godsey, University of Utah

Abstract: The Masters of Science for Secondary School Teachers (MSSST) program at the University of Utah is a disciplinary-based master's program for licensed science and math teachers. Cohorts of teachers take classes and participate in a professional learning community (PLC) in preparation for summer research experiences with a faculty member. Results from the program indicate that the research experience positively impacts teachers' knowledge of science practices and use of inquiry in the classroom. A pilot program is beginning this summer in an attempt to scale the model to other institutions and benefit a broader population of teachers. The pilot involves a stand-alone (i.e., not attached to a degree) research experience for teachers that is supported by professional development on science practices. This presentation will highlight key components of a successful research program for teachers, address barriers and challenges, and provide opportunities to discuss models for transferability to other institutions.

Roundtable 13. Refugees Exploring the Foundations of Undergraduate Education in Science

Authors: Tino Nyawelo, University of Utah

Abstract: Refugees Exploring the Foundations of Undergraduate Education in Science (REFUGES) is an outreach program that supports minority, women, immigrant and refugee students in achieving success in college. REFUGES provides hands-on science workshops and tutoring for students in four middle and high school afterschool programs located around the Salt Lake valley. Students and their families also receive social services such as parenting classes, conflict resolution, family counseling, and opportunities for positive "leisure" activities. Students in the afterschool program apply to participate in a Summer Science Bridge course where they will spend seven weeks living, attending classes, and doing research on campus.

Roundtable 14. Building a Collaborative STEM Lab Sciences Academy at the Kirkwood Regional Center at the University of Iowa

Authors: Mark McDermott, University of Iowa; Greg Petersen, Kirkwood Community College

Abstract: The STEM-focused Kirkwood Regional Center at the University of Iowa, a partnership between the University of Iowa, Kirkwood Community College and local school districts, will offer college coursework and career exploration for high school students. One course sequence under development, the Lab Sciences Academy (LSA), will provide foundational understanding and skills for further post-secondary study in science as well as opportunities to explore potential STEM-based career choices. Development of the LSA is focused on curriculum and instructional planning and on involving all partners in coursework design, discussions about infusing opportunities for University of Iowa pre-service teachers, integrating businesses, community, and research partners. This opportunity also provides

graduate students mentored teaching experiences and STEM career exploration in unique STEM learning environments. Discussion will include how all partners are involved in the development of the LSA and how it serves as a model for future unique STEM academies.

Roundtable 1. K-12 Teacher Leaders + Mathematicians + Math Educators = Partnership for Effective Mathematics Teaching and Learning

Authors: Cathy Kinzer, New Mexico State University; Kathryn Million, Las Cruces Public Schools Teacher Leader

Abstract: NMSU Mathematically Connected Communities Teacher Leadership Project is developing a cadre of mathematics education leaders in NM to improve teaching quality and increase students' learning. The NMSU College of Education and Arts and Sciences faculty partner to ensure teachers have ongoing opportunities to develop their mathematical knowledge for teaching and the pedagogical knowledge for supporting all students. The partnership project goals are: 1. Improving mathematics teaching and learning (measured through participation and school district outcomes) 2. Expanding the availability of professional learning for NM math teachers by increasing the number of effective teacher leaders that work with math educators and mathematicians throughout the year (measured by evaluations and PD outcomes) 3. Building the capacity of schools /districts through onsite teacher leaders (PD evaluations) 4. Improve the teaching and learning of mathematics for students who are often underrepresented in STEM fields (student data) 5. Show increased content and PCK (pre/post assessments).

Roundtable 2. FIU's Unique Administrator-Faculty Partnership for STEM Transformation

Authors: Elizabeth Bejar, Laird Kramer, Kathleen Rein, and Suzanna Rose, Florida International University

Abstract: At a recent White House College Opportunity Summit, Florida International University (FIU) committed to increasing STEM graduation rates by 10% by transitioning to evidence-based instructional practices across all STEM courses. This results from a unique administrator-faculty partnership that combines a grass-roots faculty effort with innovative leadership that paves the way for faculty adoption of research-based methodologies. This partnership has led to significant advances in STEM education research and practice, directly impacting thousands of enrollments annually. In the interactive panel, participants will hear from four administrators and faculty leaders spanning the College of Arts & Sciences, STEM Transformation Institute and Provost's Office in order to develop understanding of the mechanisms, research, and leadership driving institutional change at FIU.

Roundtable 3. Recruiting and Preparing STEM Teachers through Partnerships and Engagement in Mathematical, Scientific, and Engineering Practices

Authors: Larry Horvath, San Francisco State University; John Keller, California Polytechnic State University-San Luis Obispo; Frederick Nelson, California State University, Fresno; Dawn Digrius, California State University Chancellors Office; Charles Coble, The Third Mile Group

Abstract: For over a decade, STEM Education Centers throughout the 22-campus California State University system have excelled in enhancing the quality of both undergraduate and K-12 STEM education throughout the state. During this panel presentation, representatives from three CSU campuses (San Francisco State University, Fresno State University, and California Polytechnic State University) will characterize strengths and successes of each of their Centers. These include direct involvement in the recruitment and preparation of future K-12 STEM teachers through federal support (e.g., NSF Robert Noyce Teacher Scholarship Programs, DOE Teacher Quality Partnership Grants), state support (e.g., California Math and Science Teacher Initiative, California Math and Science Partnership), and foundation support. Among other topics, panelists will describe undergraduate course reform for pre-service elementary teachers aligned with the Next Generation Science Standards, partnerships with afterschool programs and informal science centers, and inclusion of authentic research experiences as a critical component of teacher preparation.

Roundtable 5. The Role of Faculty Developers in STEM Undergraduate Education Change: Tapping into Resources Locally and Nationally

Authors: Andrea Beach, Western Michigan University; Cassandra Horii, CalTech; Mathew L. Ouellett, Wayne State University

Abstract: As STEM Centers across the country work to increase faculty engagement in undergraduate science course, curriculum, and program reform, faculty developers can be key partners, within their institutions and on a national scale. Institutional change requires collaboration within and between disciplines, and faculty developers are uniquely positioned to facilitate that collaboration. For example, faculty developers can provide local preparation and follow-up to national STEM workshops, bridge STEM educational reform with broader university initiatives, and connect STEM faculty with colleagues in other units, as well as assist with strategies for recognizing and rewarding STEM reform. This roundtable discussion will quickly define the field of faculty and educational development, introduce the Professional and Organizational Development (POD) Network as a resource for STEM Centers, and discuss ways that STEM Centers can tap into the expertise and experience of the faculty development community.

Roundtable 6. The South Texas STEM Center for Professional Learning: An Innovative Approach to Teacher Development

Authors: Emily Bonner, Oscar Chavez, Guadalupe Carmona, Marta Zuflacht, Can Saygin, and Betty Travis, University of Texas at San Antonio

Abstract: There is high demand for individuals who are able to critically think through problems that are prevalent in STEM fields like computer science, engineering and life and physical sciences. Further, there is concern for the prevalent achievement gaps between minority and majority students and the need to encourage greater participation of women in STEM related careers. As such, innovative professional learning strategies are needed to equip mathematics teachers with the knowledge and skills to prepare students for STEM careers in equitable ways. This session will report on the development,

implementation, and initial findings of the STEM Center, a collaborative professional development program that centers on culturally responsive, problem-based teaching strategies. We will discuss the ways in which we structured the program based on current literature and present initial findings related to the ways in which the STEM Center has affected teacher beliefs, practice, and outcomes.

Roundtable 7. Issues in Teacher Education for Rural Mathematics Teachers

Authors: Devon Brenner, Mississippi State University; Dana Pomykal Franz, Mississippi State University

Abstract: According to the Rural School and Community Trust, one-third of schools in the United States are rural, and one in five students attends school in a rural district (Johnson, Showalter, Klein, & Lester, 2014). While much has been written about preparing teachers for urban classrooms, there has been less focus on how preservice teacher educators prepare teachers for rural mathematics classrooms. This session theorizes preparation for mathematics teaching in rural settings; conceptualizes how teachers can leverage rural funds of knowledge with their students; and, re-imagines our own interactions with potential rural teacher candidates around issues of power, perception, and deficit models of rural students (Purcell-Gates, 2002). Presenters acknowledge that recognizing the uniqueness of rural communities is the first step toward providing effective and culturally relevant mathematics education for rural students. This discussion will focus on initial work of the Rural Study Group and instituted changes to prepare future mathematics teachers.

Roundtable 12. Center for Mathematics and Science Education Graduate Fellowship Program

Authors: Alice Steimle, The University of Mississippi

Abstract: The Center for Mathematics and Science Education (CMSE) at the University of Mississippi aims to improve mathematics and science education by fostering an interaction between K---12 and university education communities, by supporting the implementation of research---based methods in the classroom and by promoting an interest in the STEM fields. In its ninth---year of existence, the CMSE has awarded a total of 26 fellowships and mentored graduate students who were/are pursuing advanced degrees in STEM education. Established to help improve the economic advancement in the state, the CMSE is producing more highly qualified teachers, school administrators, and educational leaders in Mississippi each year. Through the CMSE Graduate Research Program, the fellows are participating in a unique mentoring system, gaining a valuable experience along the way – an experience that will allow them to be change agents for STEM education for many decades to come.

Roundtable 13. Sewing In The Science: Using Electronic Textiles to Improve Science Teacher Education Programs

Authors: Colby Tofel-Grehl, Utah State University

Abstract: New models for engaging students introduce fundamental concepts of electricity and circuit design using materials not associated with traditional roles. Electronic textiles (e-textiles) are one such model that allow students to engage in science and engineering design through non-traditional projects and materials (i.e., sewing, thread, and fabric). Students who possess commonly held misconceptions

surrounding the concepts of electricity and circuits often correct those understandings through inquiry instruction (Driver, 1996). Using e-textiles as a new model for teaching science and electricity, this study reports findings of how hands on inquiry based projects both address pre-service teachers' science misconceptions and reinforce best practice science teaching methods. Secondary science teachers were found to possess commonly held misconceptions surrounding electron transfer and electricity. The use of e-textile projects in their teacher training was found to improve their understandings as well as provide a scaffolded model of best scientific teaching practice.

Roundtable 14. Providing Quality Elementary Science Teacher Education through Effective Mentor Development

Authors: Daniel Hanley, Susan Kagel, and Matthew Miller, Western Washington University

Abstract: The Science, Mathematics, and Technology Education (SMATE) Center at Western Washington University works in partnership with K-12 schools to prepare elementary and secondary preservice teachers (PSTs) to teach science. At our SMTI concurrent session, we will share an example of, and findings from, a research-based professional development model that enhances classroom teachers' ability to effectively mentor elementary PSTs in science. Our SMTI presentation addresses the Quality Education and Partnership Beyond the University strands.

Roundtable 1. Preparing Teachers for STEM Classrooms in Rural Communities

Authors: Kenneth Anthony, Dana Pomykal Franz, and Ryan Walker, Mississippi State University

Abstract: The Mississippi Department of Education has identified 48 school districts (31%) in the state of Mississippi that have a critical teacher shortage for math, biology, chemistry and physics (Hechinger Report, 2013). The Critical Shortage Act of 1998 gave the state department of education to provide incentives for teachers of critical shortage areas. College scholarships, moving and housing assistance and loan forgiveness have contributed to the influx of quality teachers to the shortage areas. However, the critical shortage of quality science teachers still exists. The Department of Curriculum, Instruction and Special Education is moving to become the center of excellence in rural teacher education. With the implementation of curricular revision in our science/math education the department will not only better serve the diverse needs of our schools, but also improve STEM education for students from under-represented communities. Strategies to be discussed include: Social media for mentoring, limitations of resources/access to technology and promoting student interest in STEM fields.

Roundtable 3. On Being an Epicenter for a Culture of Change: Challenges of a State Level STEM Center

Authors: Tami Goetz, Utah Governor's Office; Louis Nadelson, Utah State University

Abstract: Supporting, promoting and sustaining a culture of innovation and change within an institution is a complex process that requires attention to multiple facets of personal, institutional, and societal influences. The process becomes exponentially more complex when the institution is a state (Utah) and the stakeholders are K-12 school districts, institutions of higher education, informal education organizations, government and business and industry.

Roundtable 5. Understanding Student Success from a Perspective of the Total Student Experience

Authors: Julie Risien, Oregon State University; Martin Storksdieck, Oregon State University

Abstract: Building on the report Redefining Undergraduate Success at Oregon State University (Risien, Falk and Storksdieck, 2014) that was based on a campus-wide workshop in April 2014 on measures for student success, and anticipating the upcoming National Research Council consensus study on barriers and opportunities for completing 2- and 4-year STEM degrees, OSU is in the process of crafting a logic/program model for OSU student success that links incoming student characteristics (such as past experiences, cultural background and identity, agendas and motivation or academic abilities) with curricular, co-curricular, and non-programmed student experiences on and off campus, and those experiences as undergraduate students with proximate and distal sets of outcome measures for student success. In developing the model we will segment students into a limited set of typical student cases that help us better understand student-level contexts and needs.

Roundtable 7. How a Comprehensive Center for STEM Learning Can Support Achieving University Priorities

Authors: Steven Case, University of Kansas

Abstract: A comprehensive Center for STEM Learning, situated in a College of Liberal Arts and Sciences at a major research university, is having a dramatic impact on STEM literacy. Students are coming to the university, college ready and experiencing much greater success in their STEM classes as the progress through their program.

Roundtable 8. Improving the Transfer Experience: The Transfer Academy for Tomorrow's Engineers

Authors: Joseph Kulhanek, University of Texas at San Antonio

Abstract: We report on three years of experience with a summer bridging institute and mentoring program that is part of the Transfer Academy for Tomorrow's Engineers (TATE), a program designed to support transfer students in their academic journey. The particular focus of the program is grounded in local industry needs. In particular, the local engineering community indicated a need to address technical writing, presentation and group work skills in order to prepare employees that can communicate on multiple levels and work effectively in groups. Major features of the TATE program are technical writing instruction, climate research, creation of educational videos, and field research trips. Civil Engineering and Writing Program faculty facilitate the instruction and student activities.

Roundtable 9. Development of a State-Wide STEM Hub Initiative

Authors: Susan Magliaro, Virginia Polytechnic Institute and State University

Abstract: Virginia is in the process of developing a STEM education regional hub initiative to ensure high quality, accessible STEM education and career opportunities for all Virginians. Through promoting partnerships with K-12, higher education, government agencies, business and industry, and museums, VT-STEM is organizing key leaders to develop networks in their own regions, as well as contribute to the state vision for a STEM-literate citizenry. These partnerships are convening local stakeholders, hosting STEM summits, and developing programming for formal and informal K-16 STEM programs. Moreover,

each hub is branding a unique profile that highlights the expertise found its region. The purpose of this roundtable session is to share the initial framework including mission, vision, goals, activities, infrastructure, etc., as well as seek feedback from those have lead or participated in this type of state-wide initiative so that we all learn from each others' successes and challenges.

Poster. Teaching Observations and Faculty Development to Integrate Teaching Practice and Assessment of Student Learning Outcomes

Authors: Sharon McGuire, Boise State University

Abstract: This study explored the relationship between the implementation of evidence-based instructional practices (EBIPs) and student learning outcomes. Reformed Teaching Observation Protocol (RTOP) results, instructor interviews, and learning assessment data from over 50 STEM general education faculty initially showed a disconnection between the integration of EBIPs, assessment, and outcomes. These results informed faculty development programming which successfully supported faculty to integrate their teaching practice, student learning outcomes and assessment. Study results, faculty development activities, including use of the RTOP and the creation of assessment activities, will be displayed for participants to consider how these approaches might be used at their home institutions.

Poster. Creating a Cadre of Student STEM Leaders

Authors: Dabney Dixon, Georgia State University

Abstract: Student leaders are a vital aspect of undergraduate life. Accomplished senior students can be models of technical understanding, good time management, self-efficacy, and interest in opportunities for internships and careers. In undergraduate research projects, they embody hard work, acquisition of laboratory and calculation skills, networking opportunities, and the excitement of discovery. We describe efforts to create a new self-sustaining culture of excellence involving undergraduate STEM leaders. Tools have included weekly meetings to discuss research, internship and career possibilities; opportunities to polish resumes and personal statements; chances to present posters in a "friendly-eyes" environment; and career skills acquired through serving as peer leaders in Supplemental Instruction, Learning Assistant and Peer-led Team Learning programs. Measures of success include increases in participation in clubs and summer programs, fellowships and awards, outreach into the local schools, and entry into graduate and professional schools.

Poster. Partnership between an Urban University and Two School Systems: An Example of a Successful Program

Authors: Draga Vidakovic, Pier A. Junor Clarke, Christine D. Thomas, and Janice Fournillier, Georgia State University; Rabia Shahbaz, Meadow Creek High School, Gwinnet County Schools

Abstract: In this presentation we give a brief overview of the Robert-Noyce Urban Mathematics Educator Program (UMEP) Scholarship program for prospective high-school teachers that prepared them for high needs urban schools. The UMEP is a longitudinal, NSF supported program, representing a successful partnership program between an urban university and two partnering school systems. The

UMEP operated as an active Professional Learning Community (PLC) composed of the scholars, the UMEP leadership team, secondary mathematics teachers including mentor teachers and school administrators. We have maintained communication with 33 Scholars over the period of 10 years supporting and encouraging their participation in the UMEP PLC. During Phase I, the overall retention rate was 94% for the Scholars. During Phase II we extended and expanded our research on the online learning community as well as evaluated the effectiveness of the program such as degree program, selection process, and preparation and placement of the UMEP Scholars.

Poster. The Tennessee STEM Center and MTeach: A Model for Effective Teacher Preparation and Professional Development

Authors: Leigh McNeil, Middle Tennessee State University; Thomas Cheatham, Middle Tennessee State University

Abstract: The Tennessee STEM Center and MTeach at Middle Tennessee State University have partnered to provide quality education to teacher candidates, in-service teachers, and the science and mathematics educational community in the region. MTeach, the University's secondary math and science teacher preparation program, and the STEM Center have provided two intensive workshops in modeling instruction to high school teachers of biology, chemistry and physics. Participants attended workshops in the Spring and Fall, along with a 2-week summer session led by leaders in the modeling community. Working with the presenters were Master Teachers, instructors in the MTeach program, and MTeach mentor teachers, those serving as classroom models for pre-service students. Additional professional development opportunities teamed elementary and middle school in-service teachers with MTeach students, focusing on inquiry instruction and lesson design. New initiatives include pre-service teacher scholarship programs, and a research project evaluating the effectiveness of active learning strategies in the high school biology classroom.

Poster. Beyond Recruitment: How Do You Support Faculty Engagement in Pedagogical Reform by Involving Them in the Implementation Process?

Authors: Gwen Shusterman, Portland State University; Ellen Skinner, Portland State University

Abstract: Portland State University STEM faculty will co-create an optimization of curriculum and teaching practices based on deliberative democracy pedagogy in order to impact student persistence, retention, learning, and positive science identity through reform of introductory majors courses. This study is not only investigating the effectiveness of the evidence-based course reform on student outcomes; it also seeks to examine how to effectively involve and engage faculty in reform efforts. Utilizing interviews and surveys of faculty, this project will determine what types of institutional, departmental, and peer supports, as well as, what types of student feedback, faculty need to experience in order to see the feasibility and value of the reforms, leading to authentic and sustainable faculty engagement in the reform. Further study will examine how faculty implementation experiences may influence subsequent engagement in teaching, coping strategies and potential to induce institutional change in the experience and perception of STEM education.

Poster. Changing STEM Education Together through Deep K-12/University Partnerships**Authors:** Cassandra V. Horii, Julius Su, and James Maloney, CalTech

Abstract: Caltech's Center for Teaching, Learning, & Outreach (CTLO) launched in 2012 with a dual emphasis on improving university-level STEM education and partnering with K-12 STEM educators. With nearly three years of data on CTLO's activities, we report on unique outcomes of work that spans the K-Grad STEM spectrum. These include: rapid relationship-building with university faculty (over half of all tenure-track faculty in the first 2.5 years); transformative teaching methods applied to K-12, community college, and research university courses; recognition of university STEM students' engagement with K-12 projects as both service and learning; and progress with quality and success of research grant-funded educational outreach efforts. Stop by our poster to interact with and contribute to a growing toolbox of techniques and ideas for addressing STEM education across the K-Grad range, including those that serve diverse institutions, teachers, and learners.

Poster. University of Oregon's STEM CORE: Linking Research, Teacher Professional Development, and Industry Partnerships**Authors:** Bryan Rebar, University of Oregon

Abstract: University STEM education centers are uniquely poised to support teacher professional development by involving research and STEM industry partners. University of Oregon's STEM Careers through Outreach, Research, and Education (STEM CORE) leads two such projects. A math and science partnership grant supports teachers to engage in project-based teaching in collaboration with industry partners as well as science and math faculty. A STEM school project supports science graduate students who co-plan and co-teach research-inspired lessons with math, science, and English teachers. A lesson learned is the need to carefully plan facilitated time with teachers and partners, including graduate students and industry representatives, such that appropriate roles and contributions can be identified for partners. Partner involvement adds context and authenticity to lessons. Building relationships with K-12 personnel, science faculty, and community industry representatives builds capacity for continued creative collaborations included as broader impacts plans integrated with research proposals.

Poster. The Utah State University STE²M Center Model**Authors:** David Feldon, Utah State University

Abstract: Utah State University launched its STE²M (science, technology, engineering, education, mathematics) Center in 2014 in an effort to facilitate STEM education and workforce development both within the university and across the state of Utah. Its model is unique in that the director reports directly to the university provost and is not affiliated with any single college, creating a highly empowered, independent platform to advance the interests of the university in an egalitarian manner across STEM areas. In this context, the Center mission includes two focal areas: 1) scholarly endeavors to link research and practice and 2) evaluation and policy analysis services to inform and enhance STEM-relevant decision making with data. Major projects illustrated in this poster include a comprehensive analysis of the pipeline for secondary science teachers through USU with accompanying recommendations for policy and analyses for the Utah legislature regarding convergence between preparation of engineers and science teachers.

Poster. Integrating Expert Knowledge and Simulation-Based Assessment for Wastewater Management Training**Authors:** David Feldon, Utah State University

Abstract: Current methods of training of wastewater technicians have not kept pace with new technologies or innovations in instructional practices. Further, the demand for effective training will soon reach critical levels due to an increasing rate of retirements. The purpose of this project is to develop the next generation of training protocols by leveraging the expertise of the current workforce. This will be accomplished through a series of cognitive task analyses (CTAs) to capture experts' tacit knowledge, decisions, and problem-solving strategies. Using these CTAs, the investigators will develop an internet-deliverable simulation to train and evaluate its effectiveness on a cohort of students at a technical college. The current project will increase training capacity of the qualified workforce prior to the retirement of most skilled technicians, and it will also establish an effective and scalable model of training for potential workers who are geographically restricted or follow a nontraditional educational pathways.

Poster. Center for Interdisciplinary STEM Education & Partnerships at Wichita State University**Authors:** Soon Chun Lee, Shirley Lefever-Davis, Mara Alagic, and Ashlie Jack, Wichita State University

Abstract: The College of Education (COEd) at Wichita State University has made a significant contribution to the Kansas STEM education through interdisciplinary and inter-institutional collaboration i.e., Wichita Teacher Quality Partnership (WTQP), Kansas Mentor and Induction Center (KMIC), Collaboration with Fairmount Center for Science/Mathematics Education, Interdisciplinary STEM Education Certificate program, and integrated STEM education professional learning for elementary teachers in Wichita area. To expand and capitalize the COEd's infrastructure and expertise in STEM education, the Center for Interdisciplinary STEM Education & Partnerships (CISEP) will provide strong, visionary leadership in advancing STEM education and career readiness in Kansas and nationwide. This center will facilitate broadly inclusive partnerships across academia, business, education, and technology in Kansas. The primary objective of the center is to enhance the proficiency of STEM educators and administrators to enhance their impact on recruitment and retention as well as the preparation of students entering STEM fields including women and minorities.

Poster. The STEM Accelerator Program, George Mason University**Authors:** Padmanabhan Seshaiyer George Mason University; Mary Nelson, George Mason University; James Schwebach, Mary Ewell, Claudette Davis, Julia Nord, and Kelly Knight, George Mason University

Abstract: The STEM Accelerator program was created by the College of Science at George Mason University in 2011 with a focus on the success of students in STEM at all levels. In particular the program is tasked with four major goals of increasing the number of STEM majors, improving retention rates of STEM students, reducing their time to graduation, helping them join the STEM workforce or continue their education upon completion of their Bachelor's degree in STEM disciplines. Created as an interdisciplinary unit, this division consists of faculty members from multiple departments who have special responsibilities besides teaching that includes coordinating and promoting STEM activities that help achieve the four primary goals. In this work we will share the various initiatives that are

coordinated by the STEM Accelerator program to accomplish these goals at all levels for students and teachers that are supported by both state and federal grant agencies.